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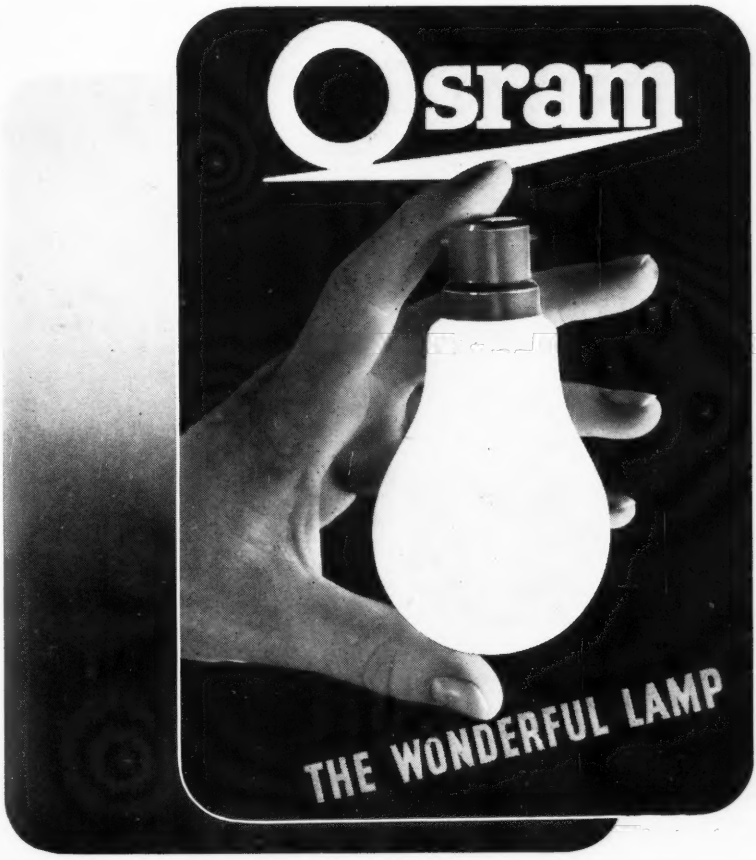

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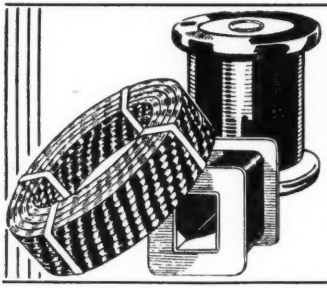

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ELECTRICAL REVIEW

July 2, 1943

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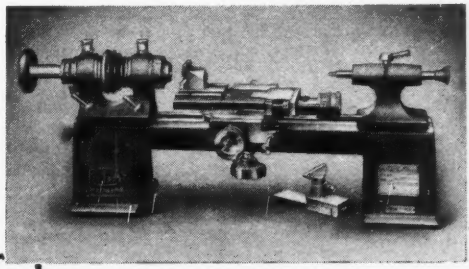

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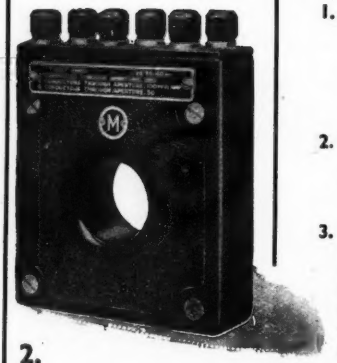

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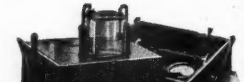

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXIII. No. 3423. JULY 2, 1943 6d. WEEKLY

Evolutionary Change

Three Main Issues in Electricity Distribution

LAST week attention was drawn to the views of the municipal side of the electricity supply industry, as expressed in the annual report and at the annual meeting of the Incorporated Municipal Electrical Association. It was then indicated that the I.M.E.A. intended to press for public ownership of the whole of electricity supply and had thereby seemingly created a barrier to the preparation of any scheme agreeable to the industry as a whole. We expressed the opinion that the electricity supply companies, still for the most part energetic and strong concerns, had not said the last word on these matters.

In this issue we publish an article from Sir Arnold Gridley who, while not writing directly as a spokesman for "private" ownership, may be said to be a representative figure on that side of the industry. He has had practical experience of electricity supply problems, with the added advantages of having served as the Controller of Electric Power during the last war and, more recently, of enjoying day-to-day contact with the public's representatives in Parliament.

Tariffs, Voltages and Numbers

Writing from this all-round experience Sir Arnold maintains that there is no case for a revolutionary change, but focuses attention on three principal issues to which attention should be paid, *viz.*, uniform tariffs, standard voltages and grouping of undertakings. The first two appeal mainly to householders, who are in a numerical majority; it is significant that industrial power and traction, which absorb some 60 per cent. of the output of the generating stations, figure little in current controversies. Unfortunately, desirable conformity to type in tariff structures is confused by many people with a uniform price per kWh. This is a viewpoint that ignores certain fundamental limitations, not the least of which is the influence of elasticity of demand, upon which progressive load-building is based. The voltage question has many features in common with frequency standardisation and would, no doubt, lend itself to a somewhat similar solution.

Slow Progress in Grouping

Although the number of separate undertakings has been considerably reduced in the course of years, the movement may be regarded as too slow in the light of figures given in the McGowan Report. These showed that, taken in the aggregate, the smallest undertakings are handicapped by their size in providing the needful quality of service to consumers, which must always be the touchstone. Nevertheless, the position destined for smaller undertakings some of which compare well in this respect with many authorities with large outputs has not yet been satisfactorily determined.

Regarding the future, Sir Arnold considers that much will depend upon the ability of sectional interests within the industry to work together in presenting an agreed scheme. Acceptance of the Government invitation to do this would, indeed, silence a more serious criticism of the

industry than any made on the score of the shortcomings to which we have referred. Action on these lines would retain the initiative for future development in the hands of those who know, by experience gained in the evolution of the industry from small beginnings, what is likely to be in the truest interest of the public.

The fulfilment of these hopes seems to have received a serious setback. Is it too late for the industry to make another attempt to get together, or is the I.M.E.A. irrevocably committed to a policy which can only result in a suggestion for a sectional, and thus not generally acceptable, solution?

American Power Plans

IT is interesting to compare the proposals of the United States National Planning Board for the future development and control of American power resources with what has been done and what is proposed in this country. Until the war period State control in the U.S.A. had not been very close. The Federal Power Commission, for instance, has never exercised as much authority as our Electricity Commissioners. On the other hand, Federal agencies have been set up which represent much greater governmental activity than we have had here; the Rural Electrification Administration and the Tennessee Valley Authority may be quoted as examples. The Planning Board now proposes the establishment of a Federal agency or corporation "to guide the development and use of electric power in the public interest," and a basic system of publicly-operated high-voltage lines.

Distribution

THE Board considers that distribution should remain in the hands of independent local groups—public and private—which would not be compelled to purchase their requirements from a publicly-owned system but would be free to buy energy from the most advantageous sources. This seems to suggest a continuance of competition and a possible duplication which has been avoided here.

Scientists' Warning

THE very effectiveness of the war contributions of science may lead to extravagant hopes on the part of the public that an era of plenty can be produced in a similar way in post-war years. The applications of research mature slowly, however, and even if research had been liberally enough endowed in the past to produce far-reaching results in the near future, it could do so only within the range of the natural resources of the country. A timely warning against the ill consequences of disillusionment has been sent out by the Joint Council of Professional Scientists. It would certainly be bad for research, for which provision should now be made on a scale not hitherto approached.

No Technocracy

NEITHER should too much be expected of scientists and technologists. Although as individuals they might well take more interest in social problems and, either in individual or corporate capacities, seek to influence politicians by suggesting remedies based upon ascertained facts, it is not in their province, as scientists, to decide national policy, which depends largely upon non-material factors. The Council says that a scientific and soul-less technocracy would be the worst form of despotism.

Neglect of Safety

SUMMONSES relating to the guarding of machinery have hitherto been issued against employers although many of such cases have proved to be the result of carelessness on the part of employees. The *A.E.U. Monthly Journal* for June mentions what is said to be the first prosecution operating the other way. A member of the Union was proceeded against by a factory inspector for failing to utilise properly the guard on a horizontal milling machine. The default was admitted and the man was fined. The factory inspector said that his object was to impress on all operatives their responsibility in relation to safety precautions as well as managements.

Prisoner-Candidates

ARRANGEMENTS made by the Institution of Electrical Engineers, through the British Red Cross Society, for prisoners of war in Germany to sit for the associate membership examination are proving of practical utility. Last year eleven candidates passed one or both parts. The scheme enables the candidates not only to secure their appropriate professional status, but also to keep their technical interests alive and thus relieve the tedium of their present position.

Automatic Plating

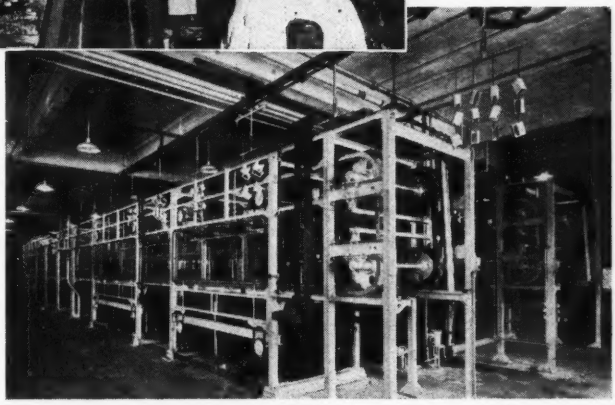
Application of Materials Handling

THE electro-plating installation with which this article is concerned deals with many types of plating, but mostly nickel and zinc on a scale permitting automatic plating in special plants, the conveyor systems of which are an essential part of a larger materials-handling scheme. Therefore, in order that the significance of the automatic - plating lines may be fully appreciated, we propose first to describe briefly the general handling scheme and processes exclusive of those on the automatic plants proper.

The plating shops are a section of a large factory and the work with which we are concerned consists of a wide variety of small components of the factory products. Thus, in the first place we have a link with a greater materials-handling scheme by means of a main factory tray conveyor which delivers automatically, on the tilting-tray principle, the components to the plating-section store which represents merely one station on the main conveyor system.

From the store the components are first taken to an I.C.I. trichlorethylene degreasing equipment in which the solution is boiled by a steam coil at the bottom and the vapour is condensed by a cold-water coil at the top; the vapour removes the grease from the work. Back to the store again and the work is then fed to a steel-band conveyor which serves two lines of girls, one on each side of the conveyor, threading the components in bunches on wires ready for the plating vats. The conveyor is driven by a ½-HP, 925-RPM motor and transmission *via* a gear box and chain results in a band speed of 8 ft. per minute.

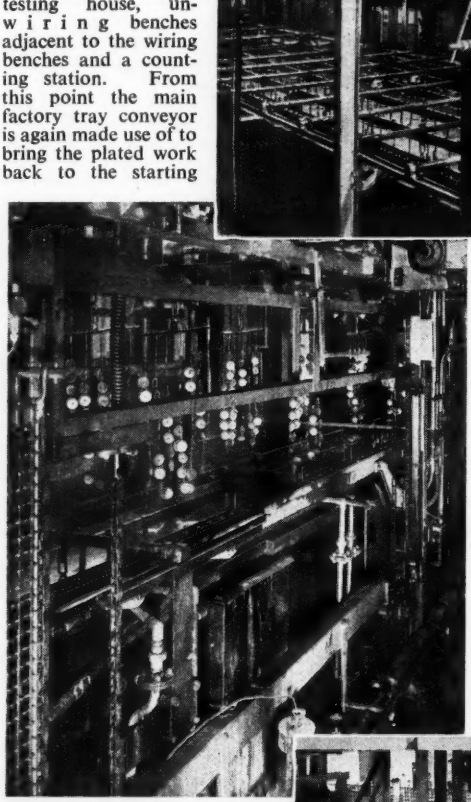
The girls pass their wired bunches on to bench jigs from which the work is transferred to an overhead continuous chain conveyor. This has a very tortuous path so that it serves various sections of the plant in such a way that the work is passed from process to process in correct sequence with the minimum of manual handling. For instance, on the outward journey it passes the feeding ends of the two automatic plating lines and on the home-



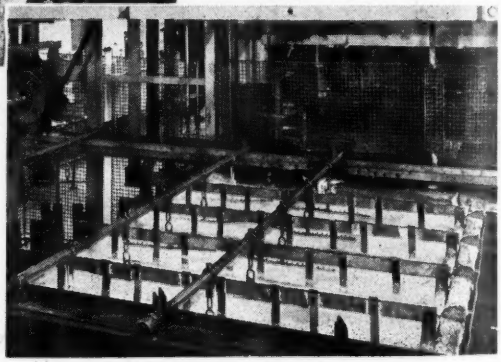
Above: Components are fed to a band conveyor which serves two lines of girls who thread the components in bunches on wires ready for the plating vats; note sections of chain conveyor Right: On the outward journey the chain conveyor passes the feeding ends of the automatic plating plants

ward journey the delivery ends of the same lines. Between these two points it also serves a lacquering station, and on the last lap it passes a testing house, unwiring benches adjacent to the wiring benches and a counting station. From this point the main factory tray conveyor is again made use of to bring the plated work back to the starting

In the deposition vat, zinc anodes are suspended from copper busbars arranged longitudinally along the automatic line



Above : At each end of the automatic line, above the conveyor, a carriage is raised and lowered and pushed to and fro under the control of limit switches
Right : In the cleaning sections foreign matter is removed from the work electrically by means of anode and cathode systems

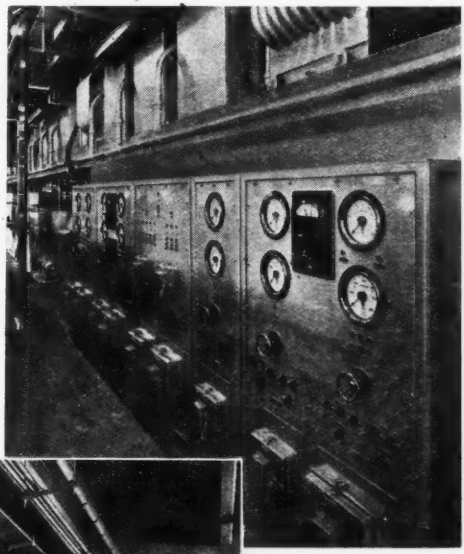


point—the departmental store. The chain conveyor is 680 ft. long and consists essentially of Renold steel stud chain in lengths of 2 ft. 3 in. with universal attachment bronze blocks which are bolted to mild-steel plates carrying ball-bearing trolley wheels which run on the rails incorporated in the chain housing. Work suspension hooks are spaced at 4 ft. 6 in. centres. The complete conveyor has a geared driving unit of only ¾ HP and bevel reduction gears provide a chain speed of 35 ft. per minute. In the driving head are tension springs and a limit switch.

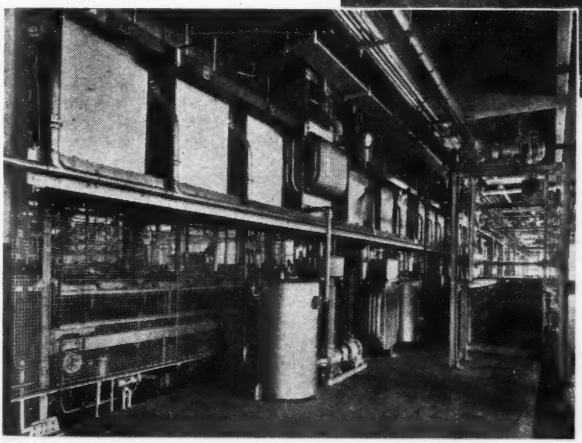
At the lacquering stations zinc-plated work is first drained and dried before being sprayed. Drying is effected in a steam-heated conveyor oven at 140/150 deg. F. The chamber measures about 20 ft. by 9 ft. and the electrically driven suspension conveyor runs at such a speed that it takes about 15 min.

for an article to complete the U-shaped circuit in the oven. At the test house samples of the work are taken at random. These are tested for the amount of deposition by weighing before and after the deposition is dissolved in acid and calculating the weight in milligrammes per sq. in. of deposition area on the work.

With the above picture of the general handling scheme we can now better tackle the automatic plating plants. There are two of these, a five-line zinc plant and a two-line nickel plant. These are so similar that it will be sufficient to describe in detail the zinc plant and simply cite a few essential differences. The ten tanks in the line progressively from the feeding end are: first cleaner, water, second cleaner, water, 5 per cent. sulphuric acid, water, zinc solution (deposition), cold water, cold water and hot water. The total length of the line is 130 ft.; the plating vat proper is 50 ft. long and the other vats are 3 ft. or 6 ft. long. In the deposition vat zinc anodes are suspended from copper busbars which are arranged longitudinally along the automatic line and spaced so that when the lines of work are immersed in the solution they are interspersed with the lines of anodes.



There is a separate panel on the control board for each electrical section of the plating plants, and all the auxiliaries are controlled from a separate panel



Each bank of rectifiers is solid connected electrically with a corresponding bank of transformers, and each bank is completed by a voltage regulator; rectifiers and transformers on gantry

The depositing current is varied with the class and quantity of work from 8 to 12 A per sq. ft. at from 3 to 4 V. The total plating current employed for the complete vat averages about 3,000 A, while in the case of the nickel plating vat (two lines only) the average total current is 2,000 A. These different current values indicate the essential difference, apart from the actual anode materials, of course, between the plating processes in the zinc and nickel lines. As far as possible the quantity of work passing along the line, and hence the current value, is maintained constant. To permit the use of higher current values and hence quicker deposition, and to avoid the formation of strata in the solution, this is agitated by means of compressed air, the degree of agitation being varied according to the quantity and class of work in the vat. Over-agitation results in light work being just "blown around." The plating-vat solutions in both the zinc and nickel plants are circulated continuously through filters, the necessary make-up for the vats being introduced at the filtering point.

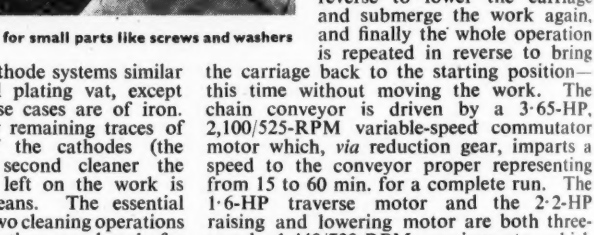
Storage tanks outside the building enable the vats to be emptied when necessary.

In the two cleaning sections proper, as distinct from mere washing, foreign matter is removed from the work electrically by means of anode and cathode systems similar to those of the actual plating vat, except that the anodes in these cases are of iron. In the first cleaner any remaining traces of grease are drawn off the cathodes (the work), while in the second cleaner the removal of any stains left on the work is assured by similar means. The essential difference between the two cleaning operations lies in the different solutions employed, for the electrical operating conditions are about the same, namely 6 to 8 V, and 15 to 20 A per sq. ft. of cathode (work). The total average current for each cleaner in the zinc plant is 1,200 to 1,500 A. The corresponding figure for each cleaner in the nickel plant is 500 A.

Barrel-plating is employed for small parts like screws and washers

A double - chain conveyor with one chain on each side of the vats runs continuously throughout the entire length of the automatic plant, carrying with it by means of upward projections the bars from which the bunches of work are suspended, so that the work is carried progressively through the various solutions. Over the cleaning and washing tanks at each end of the plant and above the conveyor is a carriage by means of which the rows of work are lifted from one tank and passed on to the next as required. Two independent double motions bring this about—one up and down, and the other to and fro—each double motion being served by its own reversible motor. Suitably placed on the conveyor-chain housing is a switch which is depressed by a wheel on the carriage as this moves forward.

The result is that all the work is lifted completely out of the cleaning and washing tanks. At its upper limit a projection on the carriage actuates a second switch by which the other motor runs up so as to propel a horizontal rod longitudinally in line with the plant. This pushes the carriage along so that each row of work is moved to the starting position over the next tank or tank section. Operation of a third limit switch then runs the first motor in reverse to lower the carriage and submerge the work again, and finally the whole operation is repeated in reverse to bring the carriage back to the starting position—this time without moving the work. The chain conveyor is driven by a 3·65-HP, 2,100/525-RPM variable-speed commutator motor which, *via* reduction gear, imparts a speed to the conveyor proper representing from 15 to 60 min. for a complete run. The 1·6-HP traverse motor and the 2·2-HP raising and lowering motor are both three-speed 1,440/720-RPM equipments which transmit through suitable reduction gear.



Careful timing of the process renders cadmium plating semi-automatic

The low-voltage high-amperage DC supplies to the cleaning and plating sections of the automatic plants are provided by selenium metal type rectifiers. There are, all told, 17 rectifiers, each with a 1,000-A output, but they are arranged in parallel

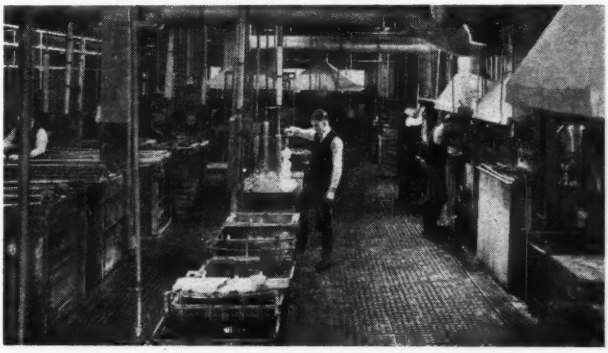
groups for serving the various sections as follows: zinc-plating vat six; nickel-plating vat three; and each cleaning section on either plant two. All the rectifiers are oil cooled, their oil inlets and outlets, respectively, being connected in parallel and the whole arranged in series with a water-cooled equipment. A motor-driven pump keeps the oil continuously circulating through the rectifiers and the cooler. Each rectifier tank is fitted with a thermostat set at the safe maximum temperature of 65 deg. C., and in the event of overheating the thermostat operates a warning on the corresponding panel of the control board.

Each bank of rectifiers is solid connected electrically with a corresponding bank of transformers which supply the rectifiers directly at three-phase, and solid connected on the DC side also with the busbars of corresponding sections of the plating plants. The 12-V rectifiers are bridge connected and the 6-V ones are connected push-pull. The transformer primaries are supplied at 415 V three-phase. Operating in conjunction with each bank of rectifiers and transformers is a voltage regulator of the induction type connected directly across the 415-V AC mains, but controlled by a DC relay connected across the mains of the corresponding section of the plating plant, so that the voltage can be kept constant irrespective of variations of the current (DC). This relay can be set at any predetermined value by means of a rheostat on the control board and it provides directional control of the motor driving the regulating coil.

For each of the three DC sections on each plating plant—one plating and two cleaning—there is a corresponding panel on the control board. The equipment on each of these panels includes a switch-fuse governing the supply to the rectifier-transformer-regulator bank, hand-operated rheostats for regulating both voltage and current on the DC side, *via* the DC relay, and a double-pointer temperature-indicator for the plating vat.

One pointer of the temperature instrument is pre-set by hand and when the actual indicating pointer passes this an alarm is operated. All the AC auxiliary motors on both the nickel and zinc plants are push-button controlled from a separate panel on the control board.

Cadmium plating is not demanded on a scale sufficient to warrant fully automatic plant, but the careful timing adopted on a "Rotamatic" vat renders it semi-automatic. An endless conveyor at the top of the vat carries the suspended work through the solution and is time-controlled from 7 to 60 min. so that one complete circuit round the conveyor completes the plating process.



Quantities not large enough for automatic plating are dealt with in a section equipped with hand-operated vats

The conveyor is driven by a small constant-speed motor and the speed of the conveyor is varied mechanically by means of a variable speed gear box. The anodes are arranged at the centre within the orbit of the conveyor and all round the vat. The DC supply at 4 V is provided by a motor-generator set and the amperage employed is from 10 to 15 per sq. ft. according to the shape and size of the work. Full out, the total vat amperage may be 600.

Barrel Plating

For nickel, cadmium and zinc plating very small parts like screws and washers, barrel plating is employed, and for this purpose there are various sizes of barrels for different classes of work. In each the anode takes the form of a suspended disc and the individually motor-driven barrel is revolved around the disc. The DC plating current is supplied from a motor-generator set at 10 to 12 V and the current control is a very much cruder affair than that with which we are mainly concerned in this article, the current being regulated merely by the quantity of the work. After plating is completed the work is washed and then dried in a centrifuge.

Finally, there is a section equipped with various hand-operated vats for dealing

with work in quantities not large enough to warrant automatic plating. With one exception, the chrome vat, all these equipments are served by the same 10-V m.g. set. Chrome demands 12 V and the vat is thus supplied from the barrel - plating machines. The different processes require different current values, however, and the necessary adjustments are made by hand-operated rheostats. These vats each measure 6 ft. by 2 ft. 6 in. by 3 ft., and the various electrical conditions are: copper, 3 V, 10 A per sq. ft.; nickel, 3 V, 5/15 A per sq. ft. (polished low, matt high); cadmium, 5/6 V, 15 A per sq. ft.; zinc, 3/4 V, 6/10 A per sq. ft.; silver, 1/2 V, 5 A per sq. ft.; gold, 2 V, 3 A per sq. ft.; and chrome, 12 V, 80 A per sq. ft.

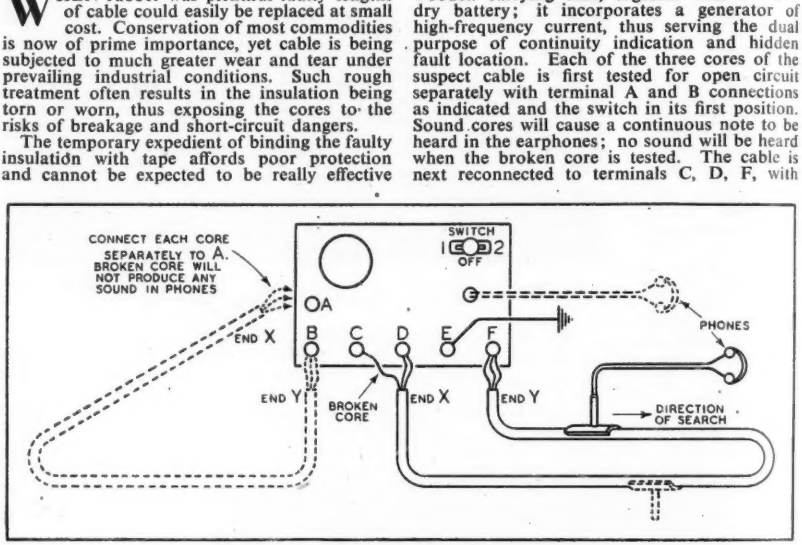
Cable Repairs

Compact Fault-Finding Set

WHEN rubber was plentiful faulty lengths of cable could easily be replaced at small cost. Conservation of most commodities is now of prime importance, yet cable is being subjected to much greater wear and tear under prevailing industrial conditions. Such rough treatment often results in the insulation being torn or worn, thus exposing the cores to the risks of breakage and short-circuit dangers.

The temporary expedient of binding the faulty insulation with tape affords poor protection and cannot be expected to be really effective treatment. If, in addition, one or more of the cores are partly or wholly severed, then cutting away the faulty portion and rejoining with the aid of insulating tape will be another equally risky form of repair that is unreliable. When breakage of internal conductors occurs without external evidence the whole length of cable will most likely be discarded without regard for economy, since endeavours to locate the position of an invisible break so often result in the cable being cut too short for it to continue serving its normal purpose. Yet all three variants of the same difficulty can be inexpensively overcome by cable users themselves with the aid of a testing instrument and repair apparatus which are offered as an outfit by the British Central Electrical Co., Ltd., 6, Rosebery Avenue, London, E.C.1.

The testing instrument is self-contained in a wooden carrying case, together with a 4·5-V dry battery; it incorporates a generator of high-frequency current, thus serving the dual purpose of continuity indication and hidden fault location. Each of the three cores of the suspect cable is first tested for open circuit separately with terminal A and B connections as indicated and the switch in its first position. Sound cores will cause a continuous note to be heard in the earphones; no sound will be heard when the broken core is tested. The cable is next reconnected to terminals C, D, F, with terminal E earthed and, with the test switch in its second position, a search shoe is moved externally along the cable, which must be unscreened, from one end to the other. When a high-pitched note becomes loudly audible in the earphones the invisible break in the cable core will be approximately within 0·5 in. of the centre of the search shoe.



Cable continuity-test and invisible fault-finding connections

The instrument, being portable, enables cables to be examined on site in works by quite inexperienced persons. When the fault position has been determined in the manner described the insulation can be opened so that the conductors may be jointed permanently, after which the rubber sheath can be re-vulcanised with a Harvey Frost appliance, which enables positive repairs to be effected in from 20 to 60 minutes according to the size and type of cable to be reconditioned.

The Supply Industry

No Justification for Nationalisation

By Sir Arnold Gridley, K.B.E., M.I.E.E., M.P.

IN these days well-meaning planners are busy with proposals for the better post-war organisation of nearly all important industries. Our industry is not escaping attention. Indeed, in many quarters it is considered one of the first that should be legislatively dealt with, for back in 1937 the matter was under the consideration of the Government. But the darkening clouds of war caused other matters to absorb attention, and the framing of a new Bill on the lines of the McGowan Report had to be deferred. We must therefore anticipate that Parliament will expect the matter to be revived and included in the Government's post-war programme. It may be that many far more urgent problems will be given higher priority, and that new legislation dealing with electricity supply may have to take a lower place than some anticipate. Nevertheless, it would be wise for those engaged in the industry or interested in its future to consider together what proposals might lead to a post-war improvement in the present organisation of the industry, for, generally efficient as it undoubtedly is, experience has indicated possible improvements.

In Parliamentary and Press discussions of the future of electricity supply, Sir Arnold Gridley has naturally taken a prominent part. In this contribution to our series of articles on the subject he maintains that revolutionary changes are unnecessary in an industry which has served the public well

Ill-informed Critics

It should be realised also that there are certain Members of Parliament who have pronounced views as to changes they deem necessary. Some of these views are not too well-informed and, in general, it is undoubtedly true that the industry is a technical puzzle about which the ordinary layman is not well educated. Nevertheless, it is Parliament that will decide what future changes shall be made, and it may be helpful if some of these anticipated changes are now indicated. As a serving member, it may be that, more than most of your contributors, I am able to show what these are.

1.—There is the widely held view that there should be a uniform price everywhere, at least for domestic consumption, if not for industry. I think it is true to say that when Members of Parliament talk about a uniform price, they mean that the actual charge per unit shall be universal and not that " tariffs " should be precisely the same, for " tariffs " are not well understood. Charges in two parts, or on the number of rooms, or on a sliding scale, seem only to confuse the uninitiated. Is a universal price practicable ? I think not.

2.—There is also a widespread demand that the same type and voltage of supply should be available everywhere, so that domestic consumers moving from one district to another can be sure that their electrical apparatus will be suitable on any circuits.

3.—There is a strong demand for a considerable reduction in the present number of supply undertakings. It is generally felt that there are far too many small undertakings, under both municipal and company control, that ought to be merged in much larger units.

The above are unquestionably the three main points upon which many Members of Parliament feel that improvement is desirable, and whatever shape future legislation may ultimately take, it should be assumed that these three points will loom large in it. On these matters all those engaged in the industry, whether in municipal or company-owned undertakings, would be well advised to see how far common agreement can be reached. It is of the utmost importance that the industry should, if possible, speak with a united voice and be prepared to submit to the Government, at no distant date, the general outline of a scheme of future development to which the industry is willing to give ready support.

Nationalisation Ideas

There remain many other problems which will require solution. The Labour Party is more or less committed to nationalisation of all public utility undertakings such as railways, water, gas and electricity. There are undoubtedly a few Liberals and Conservatives who share that view, and there are others who favour some form of Board—not unlike that controlling London Transport—replacing the existing company and municipal electricity undertakings, with large areas allotted to such boards. How far Parliament will feel compelled to legislate in this direction will largely depend, in my view, upon the extent to which the industry itself is prepared to go in achieving the three main points to which reference has already been made.

It may be asked if, and to what extent,

the electricity supply industry has failed in its duty to the public. To that there is a complete answer. It has rendered services second to none. This is shown by the growth of the business, which is amazing. During a recent period of eighteen years, the kWh sold increased over seven times. The average price per kWh sold for lighting, heating, and cooking, has been reduced in the same period from 5·75d. to 1·57d. For power the drop has been from 1·69d. to 0·64d. and for traction and public lighting the decrease has been from 2·04d. to 0·69d. When one considers that coal is the chief item of operating expenses, and when one remembers the great increase in the cost of coal during the same period, the enormous decrease in the price of electricity indicates not only the high efficiency of the industry but also how consumers have received the benefit of this efficiency.

Effects of Two Wars

The industry has also had to face the great strain upon its resources of two wars. During the period of 1914 to 1918 the output of the industry doubled. In other words, the development of those four years equalled that of the previous thirty-four years. The tremendous demands upon the power stations and transmission systems of the country during the present war cannot yet be made public, but when statistics become available in due course they will again show what a tremendous contribution to the war production effort has been made by the industry.

The foregoing facts fully justify the reasonable claim that can undoubtedly be made, namely, that even under its present organisation, the industry has deserved well of the country. It is more than doubtful whether its performance could have been equalled under any other type of organisation, national or regional.

Position of Small Undertakings

Nevertheless, nobody will deny the future advantages that could result from a greater uniformity of tariffs and voltages throughout the country, and from the merging of smaller undertakings into larger groups. It would seem inevitable that the smaller municipal and company undertakings must be prepared to lose their individual identities, while the larger undertakings, both municipal and company owned, may survive. What the industry has to hammer out is the shape of the larger units that must be contrived and under what direction they should be governed. In this there is no room for parochialism. Big, broad-minded views should be taken. Local authorities with purchase rights over electricity undertakings may have to yield them up. Fair prices should be paid alike for both municipal and company-owned undertakings which may be merged into the contemplated larger units. Employees who may lose their jobs must be suitably compensated, but the past and present growth of the industry should ensure confidence that future progress will be at least as rapid, and that there will be room for all but very few of those now employed in the industry.

If the future organisation of the industry can be steered along the foregoing lines, the changes will be all the better for being evolutionary and not revolutionary. I can see no justification for so revolutionary a step as the nationalisation of our industry which is so often, but so erroneously, described as a monopoly. Nothing could be more untrue. The electrical industry is in keen competition with gas for all cooking and heating purposes, and with private plants, oil, etc.

If the electrical industry were nationalised, the gas industry certainly should be, and contemporaneously. An extraordinary position would follow with two nationally-owned industries in competition with one another! What possible national advantage would be gained? Yet this is a risk which the industry will run unless it can speak with a united voice on matters affecting improvements in its present organisation. The Government has invited the industry to submit its views for the future. Here, surely, is an opportunity to be seized with both hands. It is devoutly to be hoped that wise and statesmanlike counsels will prevail, and that agreed proposals will in due course be submitted to the Government for the consideration of Parliament.

Midlands Charges Reduced

THE Midland Counties Electric Supply Co., Ltd., has sent us details of the recently announced reductions in charges made in pursuance of the policy outlined by Mr. W. Shearer at the company's annual meeting. The lower charges come into operation as from June 30th and affect consumers in the areas, largely rural, of the Derbyshire & Nottinghamshire and Leicestershire & Warwickshire Electric Power Companies, the Midland Electric Light & Power Co., Ltd., and the Tamworth District Electric Supply Co., Ltd.

In future both the lighting flat rate and the prepayment rate will be 4d. per kWh. A typical existing tariff (Derby & Notts) gives the lighting rate as 6d. per kWh up to 24 kWh per quarter and 5d. thereafter, with the prepayment rate at 6d. per kWh for all consumption, so that the concession is a substantial one. Under the business and domestic two-part tariff the annual fixed charges are to be reduced by 10s. (rate A) and 13s. 4d. (rate B, which has a higher fixed charge and lower running charge than rate A); in the typical scale quoted the running charges are ¾d. and ½d., respectively. Power consumers under the industrial m.d. tariff are to be advised individually of adjustments in m.d. charges, "unit" rates and coal clause. Additional meters are charged for at 1s. 6d. per quarter, the first being installed free.

The new rates compare favourably with those ruling in Midland cities and towns and meet the demand for greater uniformity.

American Post-War Plans

Co-ordination of Power Supply

PROPOSALS of a far-reaching nature are contained in a report from the United States National Resources Planning Board, entitled "A Post-War Plan and Program for the United States of America," which has been reprinted by H.M. Stationery Office and published at the price of 1s.

Space limitation precludes an adequate summary of the report; we must be content to indicate its nature and devote particular attention to the electrical section. The Board's aim is to ensure for every citizen a full and free life, unclouded by economic fears or political oppression.

Great public power-development schemes in the United States have created a situation far more complicated than that which exists in this country, but in some respects our problems are similar and it is therefore of interest to learn of the solutions propounded by the National Resources Planning Board

The first part deals with the transition from war to peace conditions, covering such matters as the demobilisation of men from the armed forces and war industries; the "demobilisation" of war plants, machines and contracts; and the removal of wartime economic controls. Next, plans for the development of an expanding economy are set out. In these the role of private enterprise is studied, fiscal policies are laid down and attention is given to the improvement of cities, transport, power, land, water and other public services.

The third part is a form of "Beveridge" report containing proposals relating to health, nutrition, education, etc., and plans for unemployment insurance and for social security. The parts to be played by State, local and regional Governments are dealt with in the fourth section. A series of ten appendices contain "supporting technical material" for the Board's proposals. It is with the fifth of these, "Valley Development," and the sixth, "Energy Resources Development," that we are principally concerned.

Water-Power Development

It is shown in the section relating to "Valley Development" that vast opportunities exist for the construction of flood control, irrigation and hydro-electric works. The conservation of water in the seven Western States, now uncontrolled, could, it is estimated, supplement or provide for the irrigation of 34 million acres of land. The cost would be more than $3,000 million and associated with the schemes is the possibility of developing 70 million kW of electric power, provided that markets were created to absorb it. Particular reference is made to the St. Lawrence project which visualises the production of 13,000 million kWh annually, almost a third of the total amount of hydro-electric energy generated in the United States in 1941. The Pacific North-West also holds great potentialities. The present plan for the main stem of the Columbia River, which will form the backbone of the regional water development programme, includes eleven dams and reservoirs of which three—Rock Island, Bonneville and Grand Coulee—are now constructed. It is estimated that this system alone, including the cost of electric power transmission, will cost at least $800 million. The contemplated ultimate hydro-electric installations at these three dams will be nearly three million kW; the potentialities of the Pacific North-West region may be nearly fifteen times that amount. The significance of this is indicated by the statement that the capacity of present-day hydro-electric plants in the United States is less than 13 million kW.

Recommendations are made regarding the part which the Federal Government and local interests should play in securing these developments.

Accelerated Progress

This naturally leads up to the formulation of a power policy. The Board points to the strain imposed upon existing sources by war demands and shows how in recent years there has been a "compounding" effect in the electric power field—increased industrialisation, increased mechanisation, increased electrification.

National policy should aim at developing low-grade energy resources and conserving high-grade and scarce resources. Methods of stimulating better use of fuels and power should be devised. Energy resources in the several regions of the country should be integrated with the object of increasing their potential for peace or war.

One element of policy is clear from immediate past controversy: there should be a unified national plan for electric power supply. An essential part of such a plan will be the co-ordination of power generation and wholesale distribution, implemented by a comprehensive system of low-cost generating stations and low-cost, heavy-duty transmission lines. This national system or "grid" would be designed initially on a regional

basis, would look toward operation on a national scale, and would be authorised as a part of the implementation of a national programme for low-cost supply of power in the public interest. As a safeguard against improper use or sequestration of such low-cost power supply, the authorising legislation should require preference to public agencies and non-profit groups among wholesale purchasers in accordance with precedents established by Congress. Recommendations in respect of the need for a national system of power supply were stated as follows in a previous report:—

"Transmission of electric energy is in many social and economic essentials closely akin to transportation of commodities. For the electric requirements of the future, the national interest will be served best by co-ordinated systems of interconnections that will make available in wider markets energy derived from the most economical sources, whether large-scale hydro-electric plants or efficient steam plants. Transmission systems of the present were integrated from smaller units to meet compelling needs for more energy supply at lower costs. There is no indication that this growth will not continue. For most industrial regions, at least, the outlook is for twice as much demand within the next decade or so. Such greatly increased needs will call for systems of supply based on large efficient steam-electric generating stations in areas of low-cost fuel, co-ordinated with storage hydro-electric plants by transmission networks extending over several States.

Proposed "Grid"

"A basic system of publicly operated high-tension lines will speed this necessary development. Transmission links between important load centres and power sources should be planned immediately as elements in such a back-bone system, not only for economy but to protect the power supply of industrial regions vital to the national defence."

There is said to be a need for a co-ordinated policy in respect of the operation of Federal and other power projects and the distribution and utilisation of supply. One possible method would be the establishment of a national agency or corporation authorised specifically to guide the development and use of electric power in the public interest. Such a corporation would operate electric power facilities in public water development projects, co-operating with other national agencies and with regional, State and other bodies for this purpose.

Through subsidiaries it might act as a joint owner, with other public bodies and even with private groups. Operating hydro-electric and steam power stations, and buying and selling power for mutual benefit on a self-supporting basis, it would deliver low-cost power to any wholesale buyer over its own transmission systems or over other lines operated as common carriers.

The Board considers that the control of distribution should remain in the hands of local groups. Independent distributing organisations, whether public, co-operative or private, would purchase their supply from wholesale agencies operating as a part of, or in co-operation with, publicly-owned supply systems. But they would remain free to purchase from better sources, if available, or to generate their own supply. Whatever form of national agency is adopted, however, it is recommended that there should be an expansion of electrification in rural areas along the lines already planned by the Rural Electrification Administration.

Expanding Use

It is advocated that the wider use and the reduction of cost should be advanced through "promotional" rate schedules, more progressive service and extension of lines; through encouraging the development and wider distribution of low-cost efficient electrical appliances, designed for the requirements of farm users and the lower income groups, with financing at low rates of interest by manufacturers, utilities or public credit agencies.

The Board says: "A central purpose of national policy for electric power will be to advance the fuller and more effective use of water power and of fuel resources in combination with each other and with other resources. By Governmental controls in the public interest, by judicious use of the public credit, by public development and exploitation of the energy resources themselves where appropriate, the use of power and fuel at the point of use should be improved—on the farm, in the household, in commerce and in industry. Such improvement should include the exercise of influence and research toward better distribution of industry and better utilisation of other natural resources in the public interest."

It is of particular interest to observe a suggestion that public power operations should be safeguarded against "(*a*) improper private attack; (*b*) poor administration; (*c*) political interference."

Durban Tramway Proposal

OWING to difficulty in coping with traffic demands Durban Municipal Transport Department proposes to run trams again on the Musgrave—Florida Road service now operated by buses. To do this it will be necessary to replace track and overhead lines at a cost of £2,835. Difficulties in obtaining steel tram tyres are stated to have been overcome by the manufacture in South Africa of a satisfactory substitute.

Synchronous Machines

Their Vector Relationships

By G. F. Freeman,
M.Sc.(Eng.), A.M.I.E.E.
(West Ham Municipal College)

THE representation of alternating quantities by means of vectors is so universal and convenient that the admirably ingenious, but all the same purely artificial, nature of the basic conventions is apt on occasion to be taken for granted.

It is now generally accepted that:—(*a*) sinusoidal alternating quantities of the same frequency shall be represented by vectors of constant length, scaled in maximum or RMS values as convenient, rotating anti-clockwise with constant angular velocity and completing one revolution in one time cycle of the supply; (*b*) associated vectors shall be "fixed" at some chosen arbitrary time which is the same for all.

On these premises a framework is erected which includes one other option, *viz.*, polarity. Here the operative word is no longer "shall" but "may," and different viewpoints are responsible for most of the controversies which arise in connection with vector diagrams; it is quite usual to treat the actual diagrams in discussion as if they had a real physical existence, and to label them "right" or "wrong," completely overlooking the fact that different interpretations are not only permissible but may even be advisable. The only significant tests are consistency and utility; if the diagrams are logically developed within the chosen framework, and give satisfactory answers to the problems they are devised to solve, their object will have been achieved.

It is helpful, when trying to decide which of two or more alternative treatments should be preferred, to examine the corresponding physical problem which involves direct,

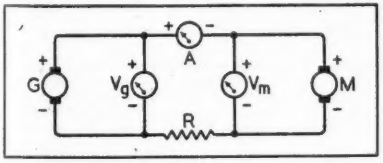


Fig. 1

instead of alternating, current and to use a system which will reproduce the same ideas, as far as possible, when alternating conditions supervene; by this means conventions which tend to create false physical pictures may be avoided. (This does not mean that they are incapable of yielding results; it is merely that they are less natural, and hence less easily visualised, in relation to normal actualities.)

Consider, for instance, the circuit of fig. 1, involving two DC machines of comparable voltage and shunt characteristic, three directional indicating instruments with negligible losses and a resistive interconnector. Such a network may be used to typify many features—

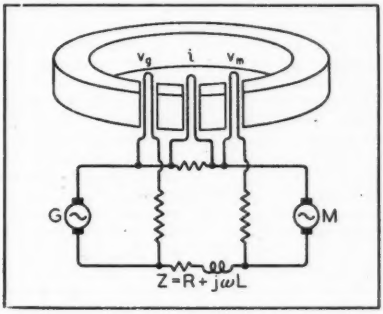


Fig. 2

sources, loads, feeders, etc.—of a "constant-voltage" supply system. This is preferred to the "constant-current" type on account of its much more frequent occurrence in practice.

With the polarities shown, if the voltage readings V_g and V_m are the same, A will read zero; if V_g exceeds V_m, A will give a positive reading I amperes, which is a generator current with respect to V_g and a motor current with respect to V_m. The relation is obviously $V_g = V_m + RI \ldots (1)$.

If on the other hand V_m exceeds V_g the current becomes "negative" and the functions of the two machines are interchanged. It is of interest that the change of function is accompanied by a physical reversal, not of voltage, but of current.

If batteries are involved, the terms "generator" and "motor" are of course synonymous with "discharge" and "charge." Should the network represent a feeder, G is the supply end and M the load end.

The AC analogy is the circuit of fig. 2. The two machines are of comparable voltage and run in synchronism, the three-vibrator oscillograph indicating their (sinusoidal) current and voltages. The non-inductive interconnector of fig. 1 is replaced by the

impedance Z, which is largely inductive in consonance with usual circuit conditions. The relation (1) now becomes: $V_g = V_m + (R + L\frac{d}{dt})i$ .... (2*a*) in instantaneous values, or $\underline{V}_g = \underline{V}_m + \underline{Z}\underline{I}$ .... (2*b*) in two-dimensional algebra (symbolic or polar numerics).

If ωL greatly exceeds R, which is normal in a synchronous machine, and V_g equals V_m in magnitude but slightly leads it in phase, I will have much the same phase as either voltage. The volt-ampere transfer is thus at or near unity power factor; the generator has a watt output and the motor a watt input, *both of which may be regarded as positive*, with very little reactive component in either case. If on the other hand V_g and V_m have the same phase, but V_g slightly exceeds V_m in magnitude, the volt-ampere transfer is almost entirely reactive, the current lagging the voltages by nearly 90 deg. The generator has a var output, the motor a var input, *both of which may be regarded as positive ;* the power transfer is very slight. As with the DC case, it will be noted that change of function is accompanied in each instance by a physical reversal of current but not of voltage. An over-excited machine generates vars, an under-excited machine absorbs vars; an over-driven machine generates watts, an under-driven machine absorbs watts.

If the circuit is to represent a synchronous machine, say a generator, of synchronous impedance Z, V_g is conveniently the induced EMF, E and V_m the terminal voltage V. Should the machine be motoring, it is more convenient to let V_g represent the terminal voltage and V_m the induced EMF; this makes the current phase differ by not more than a quadrant from the voltages (assuming stable operation). It is, however, logical to let the generator representation stand throughout, in which case the current and voltage vectors will be in power opposition when motoring (indicating a negative generator power, *i.e.*, a positive motor power). Alternatively, the motor representation may be used throughout, the current and voltage being in phase opposition when generating (indicating negative motor power, *i.e.*, positive generator power). Figs. 3a and 3b illustrate this approach. In each case the current magnitude is supposed to remain constant; the locus of the extremity of the current vector is thus a circle centred at the origin. The terminal voltage V being fixed, the locus of the extremity of the EMF vector E is a circle

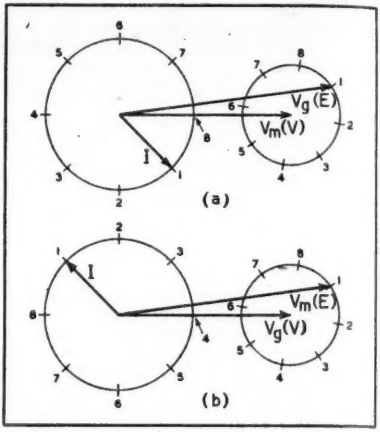


Fig. 3

The physical conditions corresponding to the numbered positions on the loci are as follows:—1, over-excited generator; 2, synchronous condenser; 3, over-excited motor; 4, unity p.f. motor; 5, under-excited motor; 6, synchronous inductor; 7, under-excited generator; 8, unity p.f. generator.

centred at the end of the V vector. The impedance angle has been taken as 80 deg.

More accurate representations of over-excited generator and over-excited motor are given in figs. 4a and 4b respectively, in which leakage reactance and armature reaction are separated in the manner usual for non-salient pole polyphase machines (Potier). In the MMF part of each diagram, F and A represent exciting and armature components and T their effective resultant. It will be noted that where the generator representation is used A is in lagging quadrature with I (fig. 4a); where a motor representation is used

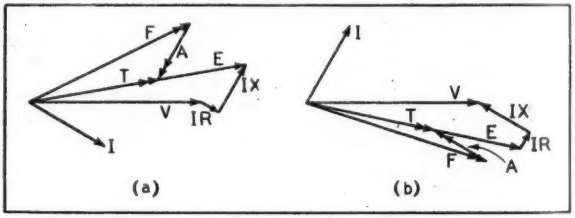


Fig. 4

A has to be in leading quadrature (fig. 4b) because of the current reversal. The object of making T collinear with E instead of in quadrature with it is to make the diagram more compact in accordance with well-known practice.

Diagrams for asynchronous machines and

transformers are readily deduced on similar lines. It is unnecessary to spread-eagle the voltage vectors.

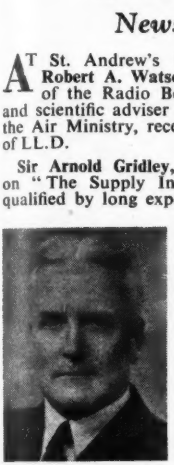
It will be appreciated that if, instead of a constant-voltage system, a constant-current system is premised (with machines of series characteristic for stability), change of function must be by reversal of voltage (EMF) since current in such a case cannot reverse. This leads logically to a different form of diagram, which is consistent within its limitations. But in my view, just as the constant-voltage system is common and the constant-current system rare, so is it more natural to develop on the lines suggested, with advantage to the student in getting closer to realities. In particular, the change of function from generating to motoring is seen to depend on quite a small change of relative field-and-armature phase; the spread-eagle diagram for a synchronous motor so commonly given rather suggests that the machine has to slip a pole in changing function, which is of course entirely wrong.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT St. Andrew's University last week **Sir Robert A. Watson-Watt,** deputy chairman of the Radio Board of the War Cabinet, and scientific adviser on telecommunications to the Air Ministry, received the honorary degree of LL.D.

Sir Arnold Gridley, the author of the article on "The Supply Industry" in this issue is qualified by long experience to deal with these matters: in particular by virtue of the fact that he acted as Controller of Electric Power Supply to the Ministry of Munitions during the last war. Sir Arnold was born at Bristol sixty-five years ago and was educated at that city's Grammar School and University College. From 1900 to 1905 he was with the British Electric Traction Co., Ltd., and was then for about two years assistant manager of the Newcastle Electric Supply Co. He became director and manager of the Cleveland and Durham Electric Power Co. in 1906 and held that position until he was appointed Controller of Electric Power Supply in 1916. Upon relinquishing this appointment in 1919 he spent some time in New Zealand and Australia and after his return (in 1921) took up the post of general works manager to the English Electric Co., Ltd., which he held until 1927. Since 1928 he has been a director of various companies in Malaya and in this country, including a number of electricity supply concerns.



Sir Arnold Gridley

Sir Arnold was created a K.B.E. in 1920 and has been senior member (Unionist for Stockport since 1935. He is a member of the Institution of Electrical Engineers.

Councillor G. Duxbury, chairman of Burnley Corporation Electricity Committee for several years, has resigned for health reasons.

The Bradford Electricity Department's Joint (Services) Comforts Fund Committee recently held a garden party in a yard, surrounded by tall and grimy warehouses in the centre of the city. The Committee entered into the project with some trepidation in view of the apparent unsuitability of the place for the purpose, but the application of hard preparatory work, plus imagination and the descriptive title of "Backyard Revels," achieved a surprising amount of success. Various departmental sub-sections co-operated and many novel attractions, in addition to the usual stalls and side-shows, were produced. An excellent concert party and an orchestra lent an air of festivity to the occasion. A children's costume parade was judged by Mrs. T. H. Carr and Mrs. A. Haselhurst, the wives of the electrical engineer and manager and the commercial manager, respectively. In the evening a whist drive was held concurrently with a cinema show and a conjuring act for the amusement of the children.

Mr. R. A. Norregard, boiler house superintendent in the St. Pancras Electricity Department, who reached retiring age in 1941, has consented to serve for a further period of twelve months until October 17th, 1944.

Mr. D. I. Evans, buyer for W. T. Henley's Telegraph Works Co., Ltd., since 1927, retired on June 30th after thirty-eight years' service with the company. He spent the whole of this time with the Buying Department, successfully surmounting some anxious periods of metal and rubber price crises. Mr. Evans is succeeded by **Mr. W. A. Lishman** as buyer, and **Mr. F. C. Walder** becomes assistant buyer.

Mr. D. I. Evans

In one of our photographs of the I.M.E.A. meeting in last week's issue we included **Mr. T. H. Carr,** who was recently appointed city electrical engineer of Bradford. By inadvertence it was made to appear that Mr. Carr was still at Derby.

Dr. W. E. Le B. Diamond, who has been assistant secretary of the Institution of Gas Engineers since 1937, has been appointed general manager of the British Plastics Federation.

A.E.U. Conference

Tribunal's Award Discussed

FOR the first time in the history of the Amalgamated Engineering Union women delegates attended the annual conference of the National Committee which was held at Southport during last week. Referring to this in his presidential address, Mr. J. Tanner said that women were now full partners with men, and they would go forward for a proper negotiated rate of pay for machine jobs on this basis; whoever did the work, men or women, would get the rate for the job.

Speaking of wartime changes in engineering, Mr. Tanner said that these would revolutionise peacetime industry. Two fundamental developments had been the breaking down of processes and the use of many new materials and methods of treating them. Plastics had come to stay, and the new light and powdered metals and the upgrading of lower-quality materials would remain an integral part of engineering products. Also, the sub-dividing of operations, new types of jigging and sub-assembly would leave their mark on future methods. Such changes meant a move away from purely craft skill; it was not the Union's business to regret this but to devise policies in accordance with it. Mr. Tanner went on to speak of the value of joint production committees, adding that the spirit which brought them into existence would be needed in redoubled strength not only to keep them going but to advance their work.

The whole of the Tuesday session was devoted to a debate on wages. A resolution demanding an advance of 11s. a week on the basic rate was dropped and it was decided to press for consolidation of the war bonus, for full restoration of pre-June, 1931, conditions, national minimum rates, for the Tribunal award of 6s. a week increase to be paid to all time workers, and for equal pay for equal work for women.

On the following day there was further discussion on the recent Tribunal award when a resolution was moved "drawing attention to the widespread discontent occasioned by the miserable award, especially the section covering plain-time workers." After Mr. Tanner had said that the award was on the right lines because it meant the stabilising of basic rates, an amendment was adopted that the executive should demand from the Tribunal a clear and full interpretation of the award in all its phases, and particularly as to how it effected members working on payment by results.

At the Thursday session a resolution was carried asking the Government to provide for income-tax deductions from current weekly earnings. The president said he understood that the Chancellor of the Exchequer was issuing a White Paper on the whole question.

On the following day a resolution was passed which aimed at securing a 40-hour working week after the war, and instructing the executive to enter into negotiations immediately to this end.

Another successful resolution instructed the executive to institute a technical training scheme in conjunction with the T.U.C., the Board of Education and employers' associations. The president stated that the Minister of Labour proposed to call a conference to discuss this problem.

Electrical Tin Plating

TIN-PLATE manufacturers employed before the United States entered the war 1¼ lb. of tin to every 100 lb. of steel. Later the Government issued an order reducing that amount to 1¼ lb., but an electrical tinning process introduced by the Westinghouse Co. is claimed to reduce the consumption of molten tin to ¼ lb. for every 100 lb. of steel. The method employs high frequency induction heating. The first steel mill using this method is now working and 12 sq. ft. of steel is covered in seven-tenths of a second, much faster than by older methods and much more economical. The coating is 30 millionths of an inch on each side of the strip so saving two-thirds of the tin needed for the old hot-dip method. Equipment is now being designed to operate at speeds up to 1,000 ft. per minute against 150 ft. in gas furnaces and only 50 ft. in hot oil.

Great care has to be taken in handling the tinned strip as the tin is very soft and is easily scratched; rehandling is avoided with induction heating as sufficient power can be dissipated in the sheet to heat the strip to the fusion point of tin, immediately after it passes from the plating tank.

Within 0·7 sec. after the strip enters the heating coil the temperature is raised to 450 deg. F., at which the tin melts and starts to flow evenly. Only a few feet of line-travel is required to produce sufficient heat when the strip is passing through the inductor coil at 1,000 ft. per minute, this flowing operation being an integral part of the tinning line, instead of a separate operation which would necessitate additional handling of the strip.

The frequency at which the required current can be induced in the strip without using abnormally high voltages depends upon the thickness of the sheet. Since tinplate is usually from 0·008 to 0·011 in. thick, approximately 200,000 cycles per second is said to be the most practical. The inductor heater coil is rectangular in form, wound as closely to the strip as is mechanically possible. It acts as the primary of a transformer while the strip itself constitutes a single-turn secondary. The induced current flows across the strip, paralleling the turns of the inductor heater coil. The power is supplied by vacuum tube oscillators, which receive rectified AC and deliver energy converted to 200,000 cycles per second to the heating inductor coil.

Mass Radiography

Newcastle-on-Tyne City Council has agreed to spend £3,500 on the installation of mass radiography apparatus for the detection of pulmonary tuberculosis.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Synchronising Lamps

I HAVE lately been interested in synchronising schemes and equipments and cannot obtain a satisfactory explanation as to why manufacturers still continue to supply synchronising lamps in addition to a synchroscope.

On the assumption that lamps and synchroscope were supplied during the interim period until the operators became used to the then new instrument I feel that the lamps, and in the case of bright-synchronising, the 1/1 transformer can now be considered redundant. Perhaps some of your readers who use synchronising equipment will let me have their views on this.

D. N. M.

Motor Standardisation

MAY I assure Mr. Marryat that I am perfectly familiar with the undoubted value of standardisation, provided this is not detrimental to other factors which lead to an electric motor being so loosely termed as "ordinary"—a word that typifies the probable accidents stressed by Mr. Marryat. I doubt, however, whether even breakdowns, due to incorrect operational duties, negligence or, in rare cases, faulty construction are of sufficient quantity to demand interchangeability.

An electric motor is a specialised power unit designed and constructed to suit certain loading conditions with maximum efficiency, starting ability and reliability. It is only natural that a certain quantity of "off-the-shelf" motors should be produced and marketed for stock. This type can be classed as "commercial" to differentiate it from special-duty motors. I can compromise with Mr. Marryat's suggestion in the case of the commercial machine only, and see no reason why the standardisation of fixing-hole dimensions should not be adopted by all manufacturers, though even here some makers might raise perfectly reasonable objections and refuse to make this concession.

I still maintain that the ever-increasing varieties of operation characteristics, different types of enclosures and the necessary large variance of frame sizes from 1 to 50 HP constitute a few of several good reasons for abolishing a demand for universal limitation of complete overall dimensions, even for commercial motors of identical outputs. Therefore, standardise fixing hole centres if it is considered necessary, but leave shaft sizes, rotor and stator diameters and elongation of frames in the hands of individual manufacturer's designers so as to allow them freedom to cope with ever-changing demands. Materials improve and ideas change and firms must take advantage of both.

The manufacturer of a line of special machines may have available certain material of better quality than would be used in small commercial machines. The firm should be encouraged to use up this material to the best advantage, and be permitted to produce machines as compactly as possible without outside restrictions for fixed dimensions. In some manufacturing conditions it is more economical to increase the material and reduce the labour cost, and again the firm should not be bound by dimensions. Because of certain characteristics a firm may have a line of machines particularly suited to, say, a Government Department, and it would be wrong to ban them from other markets during or after the war. The juggling of recognised frame sizes, referred to by Mr. Marryat, is naturally made full use of by manufacturers from their own range, but often other modifications are necessary.

Statistics just compiled by the plant engineer of a large industrial concern disclosed that during six years only 8 per cent. of 312 motors installed were changed due to failures or revised methods of production and planning. Of these less than 2 per cent. were failures, and in one case only an identical machine was changed over. This is by no means an isolated instance. On the other hand resellers who incorporate electric motors in their various types of machinery might find a certain measure of relief by the adoption of interchangeability for motors of a given output, though so far they have managed to accommodate most makes or have stuck to one maker best suited to their particular requirements or special duty.

As mentioned by one or two speakers in the discussion following Mr. Marryat's paper, it has been found already in the United States that dimensions agreed upon as standard have not necessarily been found the best, and this questionable solution has resulted in alternatives being offered.

GEO. C. SOFIANO,
Sutton Coldfield. M.A.I.E.E., Assoc.I.E.E.

Majorca Power Plant

The Spanish journal *Metalurgica y Electricidad* reports that the Sociedad Gas y Electricidad, of Palma, on the Island of Majorca, has recently been authorised to establish at Lluckmayor a small thermal power station designed for an annual output of 300,000 kWh.

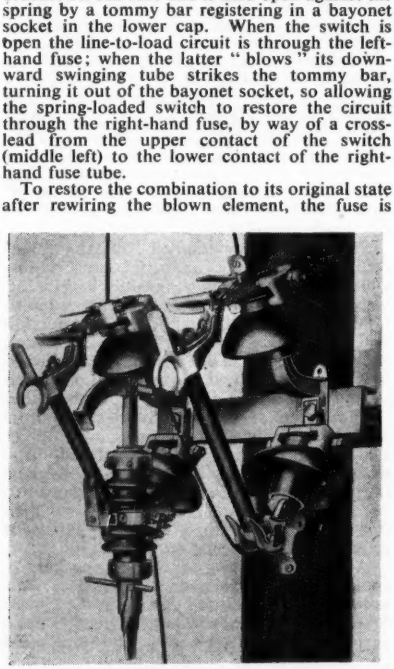
Repeating Fuse

Quick Restoration of Service

ONE of the most valuable features of the "D"-type fuse for pole mounting made by Johnson & Phillips, Ltd., is that immediately the element has "blown" the fuse tube is released in a way that allows it to swing down through an angle approximating to 135 degrees, so causing it to serve also as an isolator. The latest model utilises this downward thrust for actuating repeater mechanism that re-establishes the circuit following the occurrence of self-clearing faults with a time lag of something less than one second; an attachment is being developed enabling this short delay to be lengthened.

Two fuses with duplicate jumper line-leads are now provided for each line phase; between them a spring-loaded switch is carried by a bracket on one fuse and is held open against the spring by a tommy bar registering in a bayonet socket in the lower cap. When the switch is open the line-to-load circuit is through the left-hand fuse; when the latter "blows" its downward swinging tube strikes the tommy bar, turning it out of the bayonet socket, so allowing the spring-loaded switch to restore the circuit through the right-hand fuse, by way of a cross-lead from the upper contact of the switch (middle left) to the lower contact of the right-hand fuse tube.

To restore the combination to its original state after rewiring the blown element, the fuse is



Switch-fuse with repeater closing mechanism

closed by means of a wood pole and then, with the same pole, the repeater switch is pushed upward against the spring and the tommy bar turned into the bayonet socket. For three-phase application six fuses are required, two per phase mounted side by side or back to back, with a repeater switch for each pair. If mounting space is available two reclosures can be arranged for by using three fuses per phase, or three reclosures by using four fuses per phase, each with its own repeater switch.

Equivalent Spans

Simplified Method of Calculation

By E. C. Neate, B.Sc.(Eng.), M.I.E.E.

IN the design and erection of overhead transmission lines, particularly those using suspension insulators, the equivalent span of each section is used in the determining of ground clearance on profiles and the tension at which the conductors are required to be erected.

It has been shown* that for a transmission line section erected on pulleys the tension will vary with temperature in the same manner as a single span erected between two section points, this equivalent span being erected to the same sag-tension chart as calculated for the conductor of the line. The theory is developed using the parabolic approximation of the basic catenary equations.

With the tension thus determined it is simple to enter the sag chart and thus obtain the sag for any given span length under erection conditions, using the relation $\frac{d_1}{d_2} = \frac{l_1^2}{l_2^2}$

The equivalent span is given by:— $l_{eq.} = \sqrt{\frac{l_1^3 + l_2^3 + \ldots + l_n^3}{l_1 + l_2 + \ldots + l_n}}$, ... (1),

where l_1, l_2, etc., are the spans of the section.

By means of a very simple treatment this can be reduced to the following approximate expression:— $l_{eq.} = l_a + \frac{3}{2} \cdot \frac{\delta_1^2 + \delta_2^2 + \ldots . \delta_n^2}{l_1 + l_2 + \ldots . l_n}$ . . . . . (2),

where l_a is the average span and $\delta_1 = l_a - l_1$, $\delta_2 = l_a - l_2$, etc.

The saving in labour can be seen from the following example, which deals with a short section of grid-type construction. With the usual method of formula (1), with spans of 620, 640, 660, 600, 500 and 850 ft., the sum of these figures is 3,870 and the sum of these cubed is 1,743,093,000, so that $l_{eq.} = \sqrt{\frac{1,743,093,000}{3,870}} = 671{\cdot}13$.

Using formula (2), with a table of squares of numbers, the average span, $l_a = \frac{3,870}{6} = 645$ and δ, corresponding to the various spans, is 25, 5, 15, 45, 145 and 205. Adding the squares, δ^2, gives 65,950, so that $l_{eq.} = 645 + \frac{3}{2} \times \frac{65,950}{3,870} = 670{\cdot}56$.

The approximate value obtained is correct to the nearest foot in the example given, and in all normal cases the result will be adequate for the scale of sag-tension charts usually employed. The method requires discretion in the case where spans differ greatly from the average as in the case of a river crossing in which there are short anchor spans on either side.

* Thayer, *Electrical World*, July 12th, 1924.

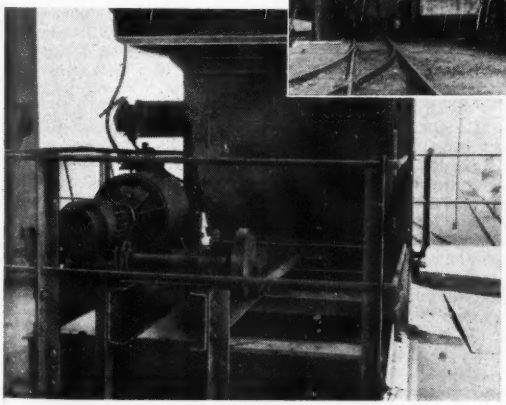
A Locomotive Depot

Maintenance and Repair Services

AFTER the war there will undoubtedly be a considerable extension of railway electrification, but in the meantime even the steam trains have to rely very largely on the use of electricity to keep them operating efficiently. A new, completely electrified locomotive maintenance and repair depot which the London and North Eastern Railway has just opened in the North Midlands is typical of several similar establishments on the company's system. This particular depot is designed to deal with the running repairs required to about a hundred engines weekly and the transfer of operations there from an obsolete depot some miles away without any dislocation of work was a notable feat of organisation.

Facilities are furnished by an automatic coaling tower for fuelling the largest engine requiring eight tons of coal or more in only three minutes. This tower, erected by Henry Lees & Co., is designed to deal with two engines simultaneously and has a hopper capacity of 250/300 tons. The hopper is kept full by means of a 25-cwt. skip which is fed *via* a semi-rotary valve from a bunker at ground level. A tippler operating on the cantilever principle discharges trucks of coal of all capacities up to 20 tons into the bunker. Six trips are made by the skip from the bunker to the hopper and back every nine minutes, so that the hopper is replenished at the rate of rather more than ¾ ton a minute.

Once put into operation, the skip, which is driven by a 15-HP, 750-RPM motor, continues to function automatically until switched off. It has push-button control operating through contactors giving " up," " down " and " stop " positions. The tippler (25-HP, 525-RPM motor) also has push-button control operating relays. To avoid damage to the plant various protective devices are incorporated, including limit and over-wind switches and phase-failure relays. An electrically driven centrifugal pump extracts any water that may accumulate in the sump beneath the chute from the bunker.



Above : An engine may be coaled in three minutes by means of this electrically operated coaling tower Left : The electrically operated shaking device of the coaling plant

Cabins for controlling engine coaling operations are provided at each end of the plant and here, by means of a pilot switch, the operator can feed to the engine bunkers almost to a lump

any desired quantity of coal, a mechanical register keeping a check for him. The switch referred to actuates a mercury switch which in turn operates contactors controlling a 3-HP, 750-RPM motor connected through worm reduction gear to "jiggers" which shake the coal on to the chutes feeding the engines. All the motors on the coaling plant are of Laurence, Scott & Electromotors construction with Brookhirst switchgear.

Above: The wheel drop used in connection with the inspection and repair of wheels, axles and axle boxes
Right: A wheel lathe suitable for re-turning and journal turning wheels up to 6 ft. diameter

Probably the most interesting piece of apparatus in the repair shop is a wheel drop (Cowans, Sheldon & Co.) which enables pairs of engine wheels to be removed for inspection and repair. The device consists of a section of the track about 11 ft. long which can be lowered at will to a depth of 10 ft. The table, which travels at a speed of 5 ft. per min. and will lift 20 tons, is driven through worm gear by a 25-HP, 700-RPM Crompton Parkinson motor. A tramway-type controller is used to operate the table and before it can be set in motion a lever has to be moved to withdraw locking bolts. Limit switches cut out the motor when the table reaches its top or bottom positions, and as the table reaches the latter, sections of the platform on each side slide inwards to complete the track and so permit the engine to be moved and the wheels returned to the surface for inspection, etc.

Re-turning of wheel tyres and journal turning will be carried out on a wheel lathe suitable for the largest wheels employed (6 ft. diameter). This is driven through reduction gear by means of a 12-HP motor. Other faults are attended to by smaller lathes, drills, grinding wheels, etc., which all have their own individual electric motors, usually with V-belt drive. In the blacksmith's shop the forges are fitted with electric blowers and there is a power hammer (40-BHP motor).

The blowing out of boiler tubes as well as the operation of many tools such as pneumatic hammers, drills, etc., is catered for by means of a large compressed air plant, comprising a twin-cylinder Broom & Wade compressor plant coupled to a 35-HP, 1,450-RPM Metrovick motor. This apparatus is provided with an Igranic control panel.

To minimise risk of failure of the electricity supply there are alternative substations at opposite ends of the depot stepping down from 11,000 V to 400/230 V three-phase AC. Locking devices on the low-voltage switch-fuses (Lucy and Sanders) prevent any chance of paralleling supplies. The external lighting (0·2 ft.-candle) for night work is controlled by a Watford switch operated from a pilot switch in the main office.

The electrical equipment of the canteen is most comprehensive and has a total loading of about 60 kW. Among the apparatus installed are a steamer, a 30-gal. vegetable boiler, a two-pan fish fryer, boiling table, griller, ovens, hot-closet, a 25-gal. automatic water boiler, and a refrigerator. About 1,000 main meals a week are being served at present. In addition to the canteen equipment there are hot-closets, grillers and water boilers in each of the three depot mess rooms.

COMMERCE and INDUSTRY

Support for J.E.A. Scheme. *New Transport Association.*

Electricity Supply Reorganisation

AT Thursday's meeting of the London and Home Counties Joint Electricity Authority the General Purposes Committee reported the receipt of resolutions by five local authorities supporting the scheme for reorganising electricity supply in the London and Home Counties District put forward by the J.E.A. The Leatherhead U.D.C. in approving the proposals suggested that they should go further so that any reorganisation included the unification of the gas undertakings of Greater London with the electricity undertakings to form one public utility undertaking under local authority control. This, it is stated, "should ensure large savings in distribution and the cessation of the wasteful competition which was taking place before the war between the two industries, which savings could then be passed to the consumer in the form of reduced charges."

It is reported that the North-Eastern Electric Supply Co., Ltd., and the Middlesbrough Corporation are to investigate the possibilities of reorganising electricity supply in the area on the basis of the McGowan Report.

Acquisition of Undertakings

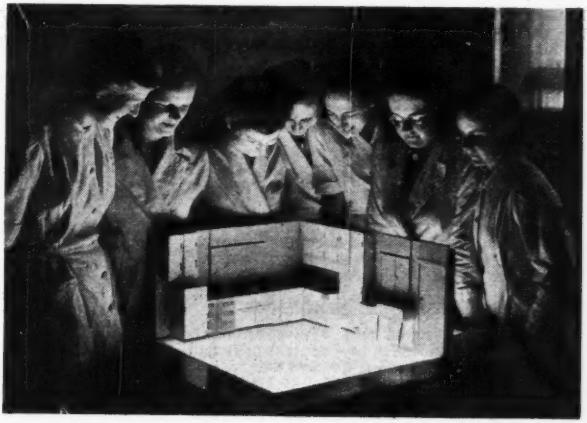
The London and Home Counties J.E.A. recently made representations to the Ministry of Fuel and Power regarding the position which might arise as the result of the failure of certain local authorities in its District to exercise their statutory rights of purchase of electricity undertakings situated in their areas. The Minister has replied that while it is realised that the matter is one which must be considered in relation to the country as a whole, he is advised that the matter could only be dealt with by special interim legislation. He appreciates the force of the Authority's contentions but considers that the importance of the issue is not sufficiently great to justify his approaching the Government with a view to instituting such legislation.

New Trade Marks Order

An Order in Council (S.R. & O. 1943, No. 746, Stationery Office, 1d.) has been made to amend the Defence (Patents, Trade Marks, etc.) Regulations, 1941. Its effect is to extend to goods imported by the Dominions or allied powers for their own purposes the protection afforded by Regulation 7 against proceedings for infringement or passing-off in connection with goods imported by the British Government. The Regulation also exempts such goods from the requirements of the Merchandise Marks Acts, 1887 and 1926, relating to the indication of the origin of goods.

Model Kitchens

The British Electrical Development Association, as many readers know, has a number of models of kitchen components with which it is possible to build up arrangements to meet the accommodation and requirements of housewives. Nowadays, of course, there is little opportunity of carrying out the "lay-outs" produced by means of the models but there is no reason why they should not be used to inculcate kitchen-planning ideas in the minds of students of home design and equipment.



Chelsea Polytechnic students using the E.D.A. kitchen-planning models

The accompanying picture shows a set of the models in use by a domestic science class at the Chelsea Polytechnic when the students demonstrated their ideas on kitchen planning to Mr. Reginald Stamp, a member of the Housing Committee of the London County Council.

"Formitis"

Mr. Walter Higgs, M.P. (of Higgs Motors, Ltd.), drew attention in a letter to *The Times* last week to the excessive number of returns asked for from industry, commerce and agriculture which, he says, is becoming an unbearable burden. He maintains that the present control could be efficiently maintained if returns were halved. He particularly objects to the control of both purchases and sales of material

when he considers that the proper control of sales should be sufficient.

He also complains of the delay which occurs when manufacturers endeavour to obtain permits for the acquisition of materials, due often to the practice of Ministries working in watertight compartments. He considers that the whole question of returns should be investigated and drastically curtailed. He does not deny that control is necessary but he emphasises that it is too complicated.

Radio-Lead Fatalities

Radio leads have been the cause of two recent cases of death from electric shock. In one, the victim, Mrs. Ellen Bond, aged fifty-eight, was found under a bush in the garden of her house with the little finger of her right hand, badly burned, round a faulty earth wire. At the inquest held at Epsom last week her husband, Dr. C. S. Bond, stated that he had seen his wife passing the window with a bowl in her hand. Reception on the radio was not good, and his wife presumably went into the garden to adjust the earth wire as they had found from experience that if it was propped up in a certain position reception improved. Evidence was given that the earth wire was "alive" when the set was switched on. The coroner, Mr. Wills Taylor, in recording a verdict of "Accidental death," asked that publicity should be given to the case so that people might be informed of the danger of tampering with radio sets.

At an inquest at Uxbridge on a 21-month-old child it was stated that the father, Mr. Frederick Gayton, of Whitby Road, Ruislip, was fixing a lead from his wireless set to his bedroom and when he left the room the child touched the wires. Dr. Gorski, the deputy coroner, recording a verdict of "Accidental death," stated that the father had been negligent.

Electricity from Next Door

As a result of a report by workmen reconnecting the supply in an empty house which had been repaired after being damaged by enemy action a neighbour was charged at Greenwich Police Court recently with fraudulent abstraction of electricity. It was stated that his own house was not wired for electricity and he had operated his radiogram by running wires from the next house. Defendant said that the occupants of the damaged house, who were friends, had suggested that he might try out the set from their supply before they moved in. He did so and as the music entertained the children he left it on. He was placed on probation for six months.

Public Transport Association

The Public Transport Association, Inc., was registered on June 22nd as a company limited by guarantee without share capital. The word "limited" is omitted from the title by licence of the Board of Trade. As we have already reported (*Electrical Review*, January 8th), the Association has been formed for the merging of the Omnibus Owners' Association and the Public Service Transport Association into one body. The first members of the Council are as follows:—R. Beveridge, 108, Morningside Road, Edinburgh, 10; E. H. Davies, Pyr Cottage, Henley-on-Thames, managing director Metropolitan-Cammell-Weymann Motor Bodies, Ltd., etc.; S. Kennedy, Red House, Stanley Avenue, Beckenham, director of Thomas Tilling, Ltd., etc.; Col. Sir Joseph Nall, M.P., Hulme House, Manchester, director of Llandudno & Colwyn Bay Electric Railway Co., Ltd., etc.; R. S. Pilcher, Broom Corner, Chelford Road, Alderley Edge, general manager Manchester Corporation Transport Dept.; T. E. Thomas, 97, Chiltern Court, N.W.1, general manager (operation) London Passenger Transport Board; J. S. Wills, Dutton Meads, Pinkneys Green, Maidenhead, director of British Electric Traction Co., Ltd., etc.; and W. Alexander, jun., R. W. Birch, J. N. Calder, G. Cardwell, F. C. A. Coventry, O. H. Corble, A. G. Dennis, S. Dudman, E. H. Edwardes, C. W. G. Elliff, S. E. Garcke, S. R. Geary, W. E. Guy, B. Hall, R. I. H. Longman, W. G. Marks, B. S. Murphy, W. C. Percival, C. C. Power, A. T. Priddle, H. G. N. Read, W. Robinson, G. Stratton, C. H. Tattam, E. L. Taylor, and J. M. Watts. The seven whose addresses are stated are subscribers to the Memorandum of Association. The solicitors are Sydney Morse & Co., Alder House, 1–6, Aldersgate Street, E.C.1.

Trade Announcements

The Transport Department of W. T. Henley's Telegraph Works Co., Ltd., has moved to Milton Court, Westcott, Dorking, Surrey (telephone: Dorking 3241), to which all communications on transport matters should be addressed.

Laurence, Scott & Electromotors, Ltd., have moved their London office to 3, Old Broad Street, London, E.C.2 (telephone: London Wall 1951).

Paper Salvage Assists E.I.B.A.

We have received from the Electrical Industry Waste Paper Recovery Committee, 2, Savoy Hill, W.C.2, a further list of firms and individuals who have passed on to the Electrical Industries Benevolent Association amounts received from the sale of waste paper.

This provides an opportunity of reminding readers not only of the importance of continued attention to the collection and disposal of their waste paper but also of the chance of being doubly virtuous by assisting the E.I.B.A. in this way.

Graphic Cable Ratings

Individual calculation of cable rating is precise, but tedious; tables of current-carrying capacities published by the E.R.A. are limited in being correct only in particular cases, whereas in practice cables are laid under very variable conditions of depth, soil resistivity and grouping.

Graphical methods of determining cable ratings seems to have been neglected in this country. Their advantages of flexibility and rapidity in use are indicated by Mr. H. Waddicor (London Power Co., Ltd.) in the *I.E.E. Journal*, Part II, June, 1943. Charts are described for rapidly ascertaining the ratings of three-phase and single-phase cables transmitting three-phase loads, laid direct in the ground or in air and taking into account the mutual heating effects of feeders laid in the same trench.

The author's charts measure 48 by 35 cm., but larger sizes are advantageous in minimising plotting errors. The maximum error involved

ranges from minus 1·2 to plus 1·9 per cent. Ratings which require well over an hour to calculate can be derived from such charts in five minutes, if necessary by personnel unacquainted with the theoretical principles and methods employed.

New Standard Specifications

Shortage of rubber and other materials has entailed certain modifications to B.S.7 and these are included in a new publication of the British Standards Institution, P.D.118 (2s. net). The most notable feature of this document is the reference to polyvinyl chloride, the use of which as a cable dielectric in place of rubber is rapidly extending. Although this compound possesses excellent qualities, including non-inflammability and resistance to oils and acids, its field has hitherto been limited by its availability in only relatively small quantities. A substantial increase in the production potential of polyvinyl chloride during the past few months has presented opportunity for further exploitation that, subject to economic considerations, is likely to leave its mark on future cable practice.

The five-year-old BS.760, which is concerned with paper-insulated cables for installation in mines, has been revised with the object of eliminating unessential types and sizes. To that end several sizes of conductor have been deleted and all conductors larger than 0·0225 sq. in. are shaped, the option of circular conductors having been withdrawn. With a few exceptions the thickness of the lead sheath has been reduced, thus bringing the specification into line with BS. 480. Copies of the new edition are obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s., post free.

BS.587, dealing with motor starters and controllers, makes no provision for the testing of starters fitted with thermal overload trips. The gap has now been filled by an addendum slip PD.119, issued gratis by the British Standards Institution.

Swiss Turbines in Canada

A three-phase turbo-generator of 500 kW at 575 V utilising live steam at 125 lb. per sq. in. at the plant of Stanfield's, Ltd., Truro, N.S., is the first installation in Canada of small-capacity sets introduced for industrial use by Brown, Boveri & Co., Ltd., Baden, Switzerland. The oil pressure governing system, controlled remotely from the distant switchboard, regulates the main throttle as well as the nozzle valves. The welded steel bedplate serves as an oil storage container, while a cooler for the forced lubricating oil is also mounted on the side of the bedplate. The two-row impulse turbine revolves at 8,500 RPM, driving the 1,800 RPM alternator with directly coupled exciter through single helical gear of a type that avoids any need for thrust bearings on the casing. Steam consumption is 47·3 lb. per kWh generated, the machine being described in *Electrical News and Engineering* (Toronto) as specially free from noise and vibration.

Change of Name

The Bexley Dynamo & Electrical Services, Ltd., has changed its name to Bex Electric, Ltd.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month from June 23rd:—

DOUGLAS. No. 615,317, Class 7. Petrol-electric generators, internal-combustion engines (stationary), engines for aircraft and ships, all for sale in England, Wales and Scotland.—Aero Engines, Ltd., Kingswood, Bristol.

HOOVERAX. No. B.622,448, Class 7. Air pumps (not for surgical or scientific purposes or air pumps for vehicles); air compressors; air purifying machines; electric alternators; bearings (parts of machines); belts for machinery; cleaning, washing and laundry machinery; dynamo-electric machines (not for land vehicles); machine tools, rotary machines; and parts (not included in other classes) of all the said goods; machine parts not included in other classes.—Hoover, Ltd., Perivale, Greenford, Middlesex.

COMMSTONES. No. 622,904, Class 7. Commutator grinding stones being parts of machines.—Martindale Electric Co., Ltd., Westmorland Road, London, N.W.9.

LATEM. No. 622,946, Class 7. Electric motors (not for land machines) and starting devices therefor, electric washing machines and coffee mills (machines). Also No. 622,947, Class 9. Electric control apparatus and electric vacuum cleaners.—The Bradford Metal Case Co., Ltd., trading also as Latem Electrical Co., Eastwood Works, Hall Lane, Bradford, Yorks.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"TROJAN" violet-ray set.

Present address of Zero Zone, Ltd., or successors.

I.E.E. London Students

THE London Students' Section of the Institution of Electrical Engineers has arranged a visit to the Charlton works of Johnson & Phillips, Ltd., on Saturday, July 10th. Applications for tickets should be sent to the Secretary of the Institution immediately and applicants must state their nationality and national registration number.

On Sunday, July 18th, there is to be a ramble in the Dorking-Ranmore Common-Shere area of Surrey; a train leaves Waterloo for Dorking North at 9.27 a.m. The arrangements are in the hands of Mr. Stefanelli, 19, Effingham Lodge, Surbiton Crescent, Kingston, who should be notified by members wishing to take part.

ELECTRICITY SUPPLY

Chester Tariff Revision. Woking Extension Application.

Blackburn.—"STAR LIGHTING."—The Corporation is to introduce "star lighting" on the main roads and town centre for an experimental period of one month, as from the end of double summer-time in August. Blackburn is one of the few industrial boroughs to maintain a complete blackout.

Burnley.—CO-ORDINATION OF CONTROL.—The Corporation has decided, on the question of co-ordinating control and where possible administration of gas and electricity undertakings, to appoint a special Power and Light Committee, to interview Salford Corporation about its own scheme. The electrical and gas engineers are also to prepare their views on the matter.

Chester.—REVISED TARIFF.—The Corporation Electricity Committee has decided to revise the tariff for rural motive power. The charges for kWh in excess of 750 are cancelled. The revised tariff is: First 250 kWh 2·475d. per kWh; next 250, 2·2d. per kWh; over 500, 1·925d. per kWh.

SUPPLY TO FARMS. — The Corporation Electricity Committee is to provide supply to farms at Dodleston and Pulford.

Croydon.—SUPPLIES TO FACTORIES.—The Corporation Electricity Committee is to provide increased supply to factories at a cost of £3,210.

Glasgow.—GASWORKS LIGHTING.—The Corporation Gas manager has been authorised to instruct the Electricity Department to install lighting points and plug points for hand lamps in a section of the Provan gasworks, the approximate cost is £170.

REFRIGERATORS.—The Corporation Sub-committee on Institutions has agreed that refrigerators shall be installed at Castlemilk House and Dunclutha Home at a total estimated cost of £200, the suppliers being the Gas Department or the Electricity Department.

London.—OVERHEAD EXPENSES.—It has been agreed that the charge made in respect of overhead expenses for work done by Hackney Electricity Department for the Civil Defence Services shall be increased from 15 to 25 per cent. As internal transactions do not justify frequent changes, the present 15 per cent. addition, although insufficient, is to be continued in the case of work done for other departments of the Council.

ST. PANCRAS.—The Electricity Commissioners have sanctioned the borrowing of £1,315 for mains and £320 for substation equipment.

Morecambe.—TRANSFORMER SITES.—The electrical engineer is to report to the Electricity Committee on securing transformer station sites in anticipation of future developments.

Walsall.—FUEL ECONOMY MEASURES.—The Property Committee reports that it has enforced various fuel economy measures in the Council House and Town Hall. These include the reduction of all 3-kW fires to 2 kW; all electric fires are to be re-connected only in wet weather and when the temperature is less than 60 deg., and no electric fires are to be provided in offices having steam radiators which give sufficient heat for the room.

MODIFIED LIGHTING.—The Works Committee, which reports against the installation of "star-lighting," explains that the bulk of such an installation would probably be valueless for post-war use and that it is questionable whether the expenditure of the money and man-power required is desirable at the present time.

Woking. — EXTENSION APPLICATION. — The Woking Electric Supply Co., Ltd., has applied to the Electricity Commissioners for an extension of a further period of three years of the time after which the London and Home Counties J.E.A. may purchase part of the undertaking authorised by the company's Order of 1940.

TRANSPORT

France.—NEW ELECTRIC TRAIN.—The *Journal des Debats* reports that the Société des Chemins de Fer Française is now testing a new "Michelin" train on the Cardinet-Auteuil section of the Chemin de Fer Ceinture. A new feature is the pneumatic tyred wheels, the earth return connection being effected by special skids. Maximum speed is 115 km per hr. and the train can stop within 160 metres at 80 km per hr.

ELECTRIFICATION PROGRAMME.—In a recent article the *Neue Zurische Zeitung* describes the present position of French railway electrification. It says that in order to complete the existing system it is planned to electrify the lines from Brive to Montauban (163 km) and Bordeaux to Montauban (206 km). At present electrification is only progressing on the Brive-Montauban line, which is expected to be ready this year. The next most urgent item on the programme is continuation of the electrification of the Montauban-Sete line towards Nimes. Preparatory work has been completed on the Paris-Lyons line and the present programme also includes the electrification of the Paris-Nimes line, which will receive electricity from a power station under construction in the East Pyrenees and from Genissiat on the Rhône. The electrification on the Lyons-Marseilles line *via* Avignon on the left bank of the Rhône, the Lyons-Marseilles line on the right bank, and the Marseilles-Nice-Mentone, Lyons-Geneva and Macon-Amberieu *via* Bourg lines is planned for the future.

NEW "METRO" LINES.—*Radio Paris* announces the building of four new "Metro" lines. The first is an extension of Line 13 which will connect Porte de Clichy with the Pont de Clichy. The second will extend the same line from Porte de Saint Ouen to the Rond-Point de Picardie. The third will run from Place d'Italie to Chantilly, and will have three new stations. The fourth will connect the Porte d'Ivry stations with Ivry Mairie.

Plymouth.—ABANDONMENT OF TRAMWAY.—The tram service from Old Town Street to Peverell is to be discontinued as soon as motor-buses are available, owing to the unsatisfactory condition of the track.

Southend-on-Sea.—TROLLEY-BUS ROUTE EXTENSION.—The Southend-on-Sea Corporation

(Trolley Vehicles) Order, 1934, empowered the Corporation to use trolley-buses between the junction of Thorpe Esplanade with Thorpe Hall Avenue and the end of the router Application has now been made for an Orde. extending the time for the exercise of these powers by three years.

Wolverhampton.—UNDERTAKING DEBT-FREE.—A luncheon was held recently to mark the occasion of the transport undertaking becoming debt-free.

In proposing the toast of The Transport Committee, Mr. A. C. Baker (Birmingham) referred to Mr. C. Owen Silvers, M.I.E.E., general manager and engineer at Wolverhampton, as one of the best-known managers of municipal transport in the country and also an outstanding personality in the sphere of national transport. Twice the population of Wolverhampton was carried daily on the Corporation vehicles, he said, and he doubted if that record was equalled by any other municipal undertaking. The toast was replied to by Alderman Alan Davies who also paid tribute to the work of Mr. Silvers.

RADIO & TELEPHONY

Exeter.—POLICE WIRELESS.—The Watch Committee is to provide a wireless scheme for the police at a cost of £1,733.

Glasgow.—EXTENSION OF POLICE WIRELESS SYSTEM.—The Scottish Home Department has asked the Corporation to grant facilities to enable the system of ultra-high-frequency police wireless to be extended to include other areas adjoining the city. The Corporation Police Committee approved of the proposals in principle, subject to a satisfactory allocation of the costs involved.

Residential Street Lighting

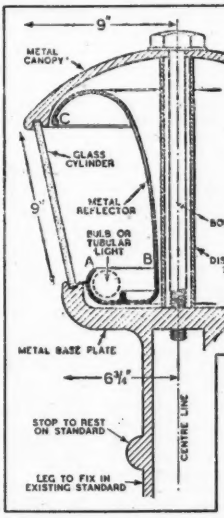
By J. A. Avery-Fowler, M.I.Struct.E., L.R.I.B.A.

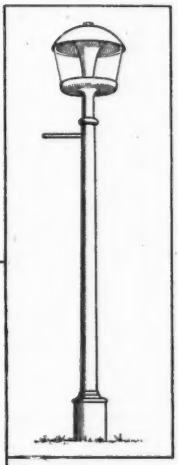
A DEFECT in the lighting of streets in residential areas of a large number of towns of varying populations has seemed to me, as an architect, to be the arrangement whereby a bulb is suspended from the centre of a rectangular-looking container with four glass sides. The only reflection of light is from an enamelled or metal double-curved plate fixed in the top of the container or lantern, and full value of this light is not obtained, a large proportion of the illumination appearing to be thrown skywards. Often this is a result of the supply undertaking having to use existing gas standards.

With a view to preparing for the future, when public lighting will be restored, I have been considering the design of a lamp fitting that could be used with any pattern of hollow standard and from which only reflected light would be thrown on to the thoroughfare.

The fitting I propose would be circular and consist of six parts:—Metal hood, shaped and grooved to receive a glass cylinder; metal bedplate shaped to receive the glass cylinder, a shaped circular reflector and a leg to fit into existing standard; distance tube between hood and bedplate; circular polished metal or enamelled reflector; circular truncated-cone clear glass; bolt and washer.

The reflector should have the portion A to B in the sketch black or non-reflecting and the portion B to C with a highly reflecting surface. Glass mirror would doubtless be ideal but for practical reasons must be ignored at this juncture. There could be two bulbs at opposite sides of the lamp, fixed to screw or bayonet caps horizontally in the recess. Would it not be possible to provide a standard pattern of tubular light resting in the trough provided? The shape of the reflector, with its lower part non-reflecting, not only prevents the light being thrown skywards, but projects it horizontally and in a downward direction where it is required. The circular shape obviates the shadows which have sometimes been the cause of accidents.





Lamp standard with proposed circular lantern for residential street lighting, and diagram of half section

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

London Electric Wire Co. & Smiths, Ltd.—Presenting the annual report at last Friday's meeting, the chairman (Mr. W. J. Terry) said that although conditions had sometimes been difficult during the year, in collaboration with the organised trade and in conjunction with the Ministries concerned they had been able to find some substitutes for scarce raw materials. He paid a tribute to the women workers and referred to the recent award on wages of the National Arbitration Tribunal which, he said, was easily misunderstood.

The directors had decided to transfer £50,000 from the investment reserve (no longer required) for the purpose of initiating a superannuation or pension scheme for the staff. This would be supplemented by an annual amount and arrangements for the scheme would be made during the current year.

Mr. Terry concluded with some remarks on post-war conditions. Both industrialists and trade unionists would agree as to the necessity for employment in full. There must be good wages with commensurate output to enable us to regain lost export markets against world competition. With regard to the question of State *versus* private enterprise, he considered that the future would require still more, and not less, private enterprise to meet the parlous condition of world trade after the war and Government control of industry should be relaxed as soon as possible.

W. T. Henley's Telegraph Works Co., Ltd., in their full report now issued, show that the trading profit for the year ended December 31st last amounted to £420,654, which compares with £410,645 in the previous year. These figures are arrived at after providing for taxation, bad debts, contingencies and special expenditure due to the war. Depreciation requires £78,920 (£74,016), directors' remuneration £8,855 (£8,750) and auditors' fees £1,500 (same), leaving a net profit of £331,379, £5,000 more than in 1941. The dividend on the ordinary stock, which is maintained at 20 per cent., including a bonus of 5 per cent., absorbs £260,000 (same) and preference dividend a further £9,000 (same), while £50,000 is transferred to war contingencies reserve (same). A sum of £390,155 (£381,276) is carried forward.

Venner Time Switches, Ltd.—Speaking at the annual meeting last week the chairman (Mr. A. A. Rowse) referred to the marked improvement in the results during the past year. He said that the efforts of the company in adapting itself to wartime conditions had been successful and the experience gained had strengthened the organisation for the transition to peacetime conditions.

There was much talk of post-war planning and no doubt much could be achieved by the wise use of the national power in the economic field. But industry must be free to act quickly if it were to secure the world markets and absorb workers into productive employment. Industry was so diverse that it would be beyond the ability of a centralised bureaucratic control to regulate it in detail.

Keith Blackman, Ltd., records gross profits for the year ended March 31st, amounting to £149,601, as compared with £118,167 in the previous year. From this have to be deducted taxes £96,080 (£64,915), deferred repairs provision £10,000 (nil) and contribution to reserve account £15,000 (same). The dividend on the ordinary shares is maintained at 20 per cent., leaving £44,546 (£46,525) to be carried forward.

Cable & Wireless, Ltd.—The ordinary general meeting was held last week, Sir Edward Wilshaw, chairman and managing director, presiding. In their report the directors regretted that they had again to record casualties among the staff. During the past year some had lost their lives while they were engaged in the service of the company, and there was still no news of the fate of many of the staff who were formerly employed in the Far East. In the present circumstances the directors were not in a position to make any further statement about the activities of the company.

Marconi's Wireless Telegraph Co., Ltd.—Presiding at the annual general meeting on June 24th Admiral H. W. Grant, chairman and managing director, said that the final dividend of 3½ per cent. on the ordinary shares making 7 per cent. for the year, in addition to the 7 per cent. already paid on the preference shares, was well covered by the profit for the year of £241,457.

The Eastern Telegraph Co., Ltd., records an income for 1942 amounting to £732,067, as compared with £730,124 for 1941. Expenses and debenture interest absorb £86,880 (£86,898), leaving £645,187 (£643,226), and after paying a final dividend of 7½ per cent., making 11½ per cent. for the year (same), a sum of £22,152 (£21,964) is carried forward.

The Eastern Extension Australasia & China Telegraph Co., Ltd., reports an income for 1942 of £334,184, from which are deducted expenses and debenture interest £35,455, leaving £298,729. After paying a final dividend of 4½ per cent., making 7½ per cent. (same), £1,447 (£2,718) is carried forward.

The Western Telegraph Co., Ltd., had an income last year amounting to £285,870 (£277,013). Expenses and debenture interest require £42,189 (£39,075), and a final dividend of 4½ per cent. is paid, making 7½ per cent. for the year. The carry forward is increased from £29,282 to £39,042.

Ruston & Hornsby, Ltd., report a net profit for the year ended March 31st last, less reserve for E.P.T., of £312,121, an increase of £21,107 compared with the preceding year. Including the balance brought forward there is a sum of £354,269 for allocation and from this has to be deducted £139,656 (£146,346) for income tax, £10,000 (nil) for pension reserve, £25,000 (same) for post-war contingencies, and £30,000 (£21,825) for general reserve. A dividend of 12½ per cent. is again paid on the ordinary

stock and £60,988 is carried forward, compared with £59,273 brought in. The accounts of the subsidiary and associated companies have shown satisfactory results for the year.

The Revo Electric Co., Ltd., is to pay a final dividend of 10 per cent. (same) and a bonus of 2½ per cent. (same), again making 17½ per cent. for the year. The net profit (after deducting taxes) for the year ended March 31st last was £72,638, against £54,317 for the previous year.

Herbert Terry & Sons, Ltd., report a net profit (after providing for taxes and depreciation) amounting to £35,090 for the year 1942, against £37,183 in the preceding year. Preference dividends take £5,375 (same), ordinary dividend (30 per cent.) £15,000 (same) and contingencies reserve £10,000 (£5,000), leaving £24,938 (£27,723) to be carried forward.

The Ebonite Container Co., Ltd., shows a net profit for the year ended February 28th, of £17,653, after providing for taxation. In the previous year the figure was £18,203. A final dividend of 5 per cent. with a bonus of 7 per cent. is to be paid, making 17 per cent. (same).

The John Thompson Engineering Co., Ltd., records a net profit for the year 1942, after providing for taxes, of £101,123, as compared with £106,530 in 1941. After paying a final dividend of 12½ per cent. (same) on the ordinary shares, plus a special bonus of 5 per cent. (same), again making 22½ per cent. for the year, £52,937 is carried forward.

The Chloride Electrical Storage Co., Ltd., is again to pay a final dividend of 5 per cent. plus a bonus of 5 per cent. on its "A" and "B" shares, making 15 per cent. (same).

The Electric Furnace Co., Ltd., is maintaining its ordinary dividend at 4½ per cent., making 8 per cent. (same) for the year.

R. B. Pullin & Co., Ltd., announce an interim dividend of 5 per cent. (same).

W. & T. Avery, Ltd., record a net profit of £138,150 (£130,407) for the year ended March 31st. The final dividend is maintained at 10 per cent., again making 15 per cent.

The British Thermostat Co., Ltd., reports a net profit for the year ended January 31st, of £34,754, as compared with £29,846 in the previous twelve months. As already reported, the dividend is maintained at 18½ per cent.

The Victoria Falls & Transvaal Power Co., Ltd., has declared a final dividend of 11 per cent. (same) on its ordinary shares, making 15 per cent. (same) for the year.

The East London Rubber Co., Ltd., states that the net profit rose from £114,199 in 1941-42 to £136,431 in 1942-43. The dividend for the year is raised from 7½ to 10 per cent.

Newman & Watson, Ltd., report a net profit of £13,094 for 1942-43 (against £13,594), before meeting income tax. The half-yearly dividend on the 6 per cent. cumulative preference shares is being paid.

The Electric Construction Co., Ltd., has declared a dividend of 12½ per cent. for the past year, against 10 per cent.

Mirrlees, Bickerton & Day, Ltd., are raising their dividend from 6 to 8 per cent. for the past year.

The General Cable Manufacturing Co., Ltd., is maintaining its interim dividend at 6 per cent.

New Companies

Para-Plastics, Ltd.—Private company. Registered June 17th. Capital, £5,000. Objects: To carry on the business of manufacturers of and dealers in plastics, rubber, synthetic rubber, resins and elastomers, and substances and articles derived or made therefrom, makers of paints, lacquers, tubing insulators and corrosion and moisture resisting materials, manufacturing and research chemists, manufacturers of textile fabrics and refractory materials, etc. Subscribers: G. Frenkel and W. G. Bailey, both of 329, High Holborn, W.C.1. Solicitors: W. Gilchrist Bennett, Grosvenor Gardens House, S.W.1.

Fine Tubes, Ltd.—Private company. Registered June 16th. Capital, £2,000. Objects: To carry on the business of manufacturers of radio and valves, parts, accessories and components, electrical and mechanical equipment, etc. Directors: H. J. Carter, 63, The Spinney, Tattenham Grove, Epsom (permanent managing director); and C. F. Bland, 11, Sir Isaac's Walk, Colchester. Registered office: Rowland Lodge Stables, College Road, Epsom, Surrey.

Mortgages and Charges

Electro Methods, Ltd.—Charge on contract or order moneys, dated June 4th, to secure all moneys due or to become due from the company to Higginson & Co., 16, Bishopsgate, E.C.

Gladiator Welder Sets, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated June 1st, to secure £420. Holder: Mrs. Lucy B. Pollock, 18, Leicester Road, Sale, Cheshire.

British Lion Battery Co., Ltd.—Debenture, charged on the company's property, present and future, including uncalled capital, dated May 27th, to secure £7,287. Holder: W. T. Reynolds, 232/4, Upper Street, Islington. (Issued at discount of £1,287 10s. to holder.)

Receiver Appointed

Combie Electric Co., Ltd.—J. L. Harper, Milton House, 35, Surrey Street, W.C.2, was appointed receiver and manager on June 9th, under powers contained in debenture dated December 18th, 1942.

Bankruptcies

T. Johnson, electrician, 233, The Wheel, Ecclesfield, lately carrying on business at 25, Granville Street, Sheffield, under the name of "Tom Johnson & Co.," mechanical and electrical engineers and contractors.—Proofs for dividends by July 7th to the trustee, Mr. A. H. Ward, 55, Queen Street, Sheffield, Official Receiver.

H. J. Fowlie, electrical engineer, 40, Queen Street, Maidenhead.—Proofs for dividend by July 9th to the trustee, Mr. J. B. Simmons, 8, Forbury, Reading, Official Receiver.

R. S. Douthwaite, wireless and electrical dealer, 156, Church Street, Whitby.—First and final dividend of 20s. in the £, payable July 15th at the Official Receiver's Office, Bank Chambers, Scarborough.

STOCKS AND SHARES

TUESDAY EVENING.

THE end of the first half of the current year finds Stock Exchange markets in firm fettle. Within the past few business days there has been a return of the good tendency which had been temporarily interrupted by " Wings for Victory " weeks. Public attention was, also, too absorbed by war developments to pay more than passing heed to stocks and shares. However, despite the war borrowing, funds keep on accumulating and must be employed in one way or another. So it has come about that Stock Exchange markets are again being combed for securities, investment and speculative, with the result that business has to some extent revived and prices are on the mend once more.

Price Fluctuations

Instead of Callender's rising to the previous plane occupied by British Insulated and Henley's, as seemed logical when their dividend was advanced to 20 per cent., the ordinary shares of the two last-named companies are receding towards the price of Callender's. British Insulated (" Wires," in Stock Exchange slang) have fallen 2s. 6d. in the past fortnight, and Henley's this week are 9d. lower at 24s. 3d. in spite of the good figures shown by the report. Callender's went ex dividend on Monday in this week; they can be bought at 93s. 6d. or less. Revo shares are 1s. to the good at 36s. 6d., the net profit for the year being £18,000 up at £72,600. Dividend and bonus are repeated at 17½ per cent. Another dividend repetition is 15 per cent. for the year on Victoria Falls & Power ordinary shares. This had no effect upon the price.

Calcutta Electric Trams continue to be the centre of dealing activity: the price has gained a further 1/16 at 43s. 9d. The only changes in the Home electricity supply market are falls of 6d. in three cases. Canadian utilities have gone back: Montreal Power to 28½, Shawinigans to 20¼. International " Tel. & Tel." are half a dollar harder at 16½.

Miscellaneous Matters

Allen Wests have changed hands up to 8s. At the middle price of 7s. 6d. there has been a rise of 6d. on the week; the shares pay 5 per cent. on the money. Associated Electrical ordinary and preference have gone back 1s. to 48s. 6d. and 39s. respectively, at which prices the yield is the same, £4 2s. 2d. per cent. Interest in radio has been subdued: speculation has turned its attention to other things. E.M.I. shares started to brighten up last Friday, when the price rallied 9d. to 23s. 6d. Cossor's hardened to a guinea. Sterling Industries preference are better at 12s. 3d. Business in the " heavy " industries' shares is quiet. Vickers are dull at 18s. 9d. Further buying lifted Oriental Telephones to 41s. 9d. on the break-up value of the shares.

Chloride Electrical

The Chloride Electrical Storage Co. has declared a final dividend and bonus making, with the interim dividend, 15 per cent. for the year to March 31st last. Similar distributions have been made annually since 1934, inclusive, except in 1938, when the bonus was 10 per cent. instead of 5. The company controls various accumulator companies and, jointly with Joseph Lucas, Ltd., is interested in Batteries, Ltd. For years past the earnings have been well in advance of the dividends paid, and the company's financial position is strong. At the present price of 82s. 6d. ex dividend the yield on the money is £3 12s. 8d. per cent. There are two classes of shares, the " A " and " B " with equal voting, but the " B " vote only in the case of winding up.

British Thermostat

The British Thermostat Co. has made up its dividend for the year ended January 31st, 1943, to 18½ per cent., which is the same as usual. The price of the shares recovered deduction of the dividend, and at 17s. 6d. xd, show a return of £5 5s. 9d. per cent. The company was formed fifteen years ago to carry on business as manufacturers of scientific instruments and general engineers, the principal manufactures being thermostatic control equipment, extending from apparatus used for motor cars to equipment for air conditioning plant, cookers, etc. The price of the shares fell three years ago to 6s. The current quotation is within 6d. of the highest reached since 1937, when the price touched 25s. 9d.

Cable & Wireless

From being the centre of lively speculative notice, the market in Cable & Wireless ordinary stock has subsided into a humdrum condition, the price moving but little from day to day. In these circumstances it is natural that the quotation should have gone back. At 77½ it shows a loss of 1½ on the week. Disappointment was felt at the comparatively small amount of margin left over after payment of the 4 per cent. dividend on the ordinary stock of the Holding Company. The ordinary general meeting of Cable & Wireless (Operating), held last week, produced little fresh information. The chairman said that in the present circumstances the directors were not in a position to make any further statements about the activities of the com-

(*Continued on page* 30)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price June 29	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	56/6	..	4 6 10
British Power and Light	6	7	31/–	..	4 10 4
City of London	7	7	29/6	–6d.	4 15 0
Clyde Valley	8	8	39/–	..	4 2 0
County of London	8	8	39/–	..	4 2 0
Edmundson's:					
7% Pref.	7	7	34/–	..	4 2 4
Ord.	6	6	28/6	..	4 4 3
Elec.Dis.Yorkshire	9	9	44/6	..	4 1 0
Elec. Fin. and Securities	12½	12½	52/–	..	4 16 1
Elec. Supply Corporation	10	10	46/–	..	4 7 0
Isle of Thanet	2	Nil	17/–	..	—
Lancs. Light and Power	7½	7½	34/6	..	4 7 0
Llanelly Elec.	5½	6	26/–	..	4 12 4
Lond.Assoc.Electric	4	3	22/–	..	2 14 10
London Electric	6	6	26/6	..	4 10 7
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	39/–	..	4 2 2
Midland Counties	8	8	38/–	..	4 4 2
Mid. Elec. Power	9	9	42/6	–6d.	4 4 9
Newcastle Elec...	7	7	31/–	..	4 10 5
North Eastern Elec. Ordinary	7	7	32/–	..	4 7 6
7% Pref.	7	7	34/–	..	4 2 4
Northampton	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10)	6	Nil	10	..	—
Northmet Power:					
Ordinary	7	7	36/6	..	3 16 8
6% Pref.	6	6	31/–	..	3 17 5
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power	8	8	37/6	..	4 5 4
Southern Areas	5	5	22/6	..	4 9 0
South London	7	7	26/–	..	5 7 8
West Devon	5	5	23/–	..	4 7 0
West Glos.	4½	3½	23/–	..	3 0 10
Yorkshire Elec.	8	8	39/6	–6d.	4 1 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	5/6	..	—
Calcutta Elec.	7*	6*	38/–	+6d.	3 3 0
Cawnpore Elec.	10	10	32/–	..	6 5 0
East African Power	7	7	32/6	..	4 6 2
Jerusalem Elec.	7	5	28/6	..	3 10 2
Kalgoorlie (10/–)	7½	5	9/–	..	5 11 1
Madras Elec.	6*	4*	24/6	..	—
Montreal Power	1½	1½	28½	–½	5 5 5
PalestineElec."A"	Nil	4*	43/3	..	1 17 0
Perak Hydro-elec.	6	7	9/–	..	—
Shawinigan Power	83cts.	90cts.	20¼	–¾	—
Tokyo Elec. 6%	6	6	20	..	—
VictoriaFallsPower	15	15	4¼	..	3 11 9
WhitehallInv.Pref.	—	—	25/–	..	4 16 1

Company	Dividend Previous	Dividend Last	Middle Price June 29	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence)	—	3	100	..	3 0 0
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	103½	..	3 7 8
1974–94	3½	3½	101	..	3 3 9
LondonElec.Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond.Pass.Trans.:					
A	4½	4½	116½	..	3 17 3
B	5	5	115½	..	4 6 7
C	2¾	3	61½	..	4 17 7
WestMidlandsJ.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	112½	..	5 6 9
Def.	1½	1½	28	..	5 7 2
Anglo-Portuguese	8	8	24/–	..	6 13 4
Cable & Wireless:					
5½ Pref.	5½	5½	111½	+½	4 18 8
Ord.	4	4	77½	–1½	5 3 4
CanadianMarconi	$1	Nil	4cts.	10/6	.. —
Globe Tel. & Tel.:					
Ord.	8½*	5*	35/–	..	2 17 2
Pref.	6	6	28/9	..	4 3 6
GreatNorthernTel. (£10)	Nil	Nil	24	..	—
Inter. Tel. & Tel.	Nil	Nil	16½	+½	—
Marconi-Marine	7½	7½	33/–	..	4 11 0
Oriental Tel. Ord.	16	10	41/9	+6d.	—
Telephone Props.	6	Nil	13/9	..	—
Tele. Rentals (5/–)	10	10	11/–	..	4 11 0
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	4/6	..	—
4% Inc.	Nil	Nil	11.	–2	—
Brit.Elec.Traction:					
Def. Ord.	45	45	1075	–10	4 3 9
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	10	10	50/–	..	4 0 0
Brazil Traction	$½	$1	33	+½	—
Calcutta Trams.	8	5½	43/9	+⅛	2 10 3
Cape Elec. Trams	5	6	25/6	..	4 14 0
Lancs. Transport	10	10	44/3	..	4 10 4
Mexican Light:					
1st Bonds	5	5	107½	..	4 13 0
Rio 5% Bonds	5	5	104½	..	4 15 9
Southern Rly.:					
5% Prefd.	5	5	75	..	6 13 4
5% Pref.	5	5	111½	..	4 9 8
T. Tilling	10	10	54/–	+6d.	3 14 0
West Riding	10	10	43/6	..	4 12 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price June 29	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord...	7½	10	41/3	..	4 17 0
Assoc. Elec.:					
Ord.	10	10	48/6	−1/−	4 2 2
Pref.	8	8	39/−	−1/−	4 2 2
AutomaticTel.&Tel.	12½	12½	57/−	−1/−	4 7 9
Babcock & Wilcox	11	11	48/−	..	4 11 7
British Aluminium	10	10	48/6	..	4 2 6
British Insul. Ord.	20	20	5⅛	−⅛	3 17 6
British Thermostat (5/−)	18½	18½	17/6xd	+3d.	5 5 9
British Vac.Cleaner (5/−)	10	15	24/3	..	3 1 10
Brush Ord. (5/−)	6	8	8/−	..	5 0 0
Burco (5/−) ..	15	15	14/3	..	5 5 1
Callender's ..	15	20	93/6xd	..	4 5 9
ChlorideElec.Storage	15	15	82/6xd	+1/−	3 12 8
Cole, E. K. (5/−)	7	10	23/−	..	2 3 6
Consolidated Signal	17	24	5⅞	..	4 8 3
Cossor, A. C. (5/−)	15	10*	21/−	+6d	1 15 9
Crabtree (10/−) ..	17½	17½	38/−	..	4 12 4
Crompton Parkinson Ord. (5/−) ..	20	20	25/−	..	4 0 0
E.M.I. (10/−) ..	6	6	23/6	+9d.	2 10 6
Elec. Construction	10	10	44/−	..	4 11 0
Enfield Cable Ord.	12½	12½	54/6	..	4 11 9
Elecl. Switchgear (10/−)	10	10	20/−	..	5 0 0
English Electric	10	10	48/−	..	4 3 4
Ensign Lamps(5/-)	25	25	21/3	..	5 17 8
Ericsson Tel.(5/−)	22†	20†	47/6	..	2 2 2
Ever Ready (5/−)	40	40	37/6	..	5 6 8
Falk Stadelmann	7½	7½	31/−	..	4 16 9
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C.: Pref. ..	6½	6½	33/−	..	3 18 9
,, Ord. ..	17½	17½	88/6	..	3 19 2
Greenwood&Batley	15	15	40/−	..	7 10 0
HallTelephone(10/-)	12½	12½	25/3	..	4 19 0
Henley's (5/−) ..	20	20	24/3	−9d.	4 2 2
4½% Pref. ..	4½	4½	23/−	..	3 18 3
Hopkinsons ..	15	17½	63/9	..	5 9 9
India Rubber Pref.	5½	5½	21/−	+1/−	5 4 9
Intl. Combustion	30	30	6½	..	4 17 10
Johnson & Phillips	15	15	69/6	..	4 6 2
LancashireDynamo	20	22½	91/3	..	4 18 9
Laurence,Scott(5/-)	15	12½	12/−	..	5 4 2
London Elec. Wire	7½	7½	31/6xd	+9d.	4 15 3
Mather & Platt	10	10	48/9	..	4 2 0
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5½	..	3 16 6
Pye Deferred (5/−)	25	25	22/6	..	5 11 1
Revo (10/−) ..	17½	17½	36/6	+1/−	4 16 0
Reyrolle	12½	12½	67/6	..	3 14 0
Siemens Ord. ..	7½	7½	30/−	..	5 0 0
Strand Elec. (5/−)	4	7½	7/6	+1/−	5 0 0
Switchgear & Cowans (5/−) ..	10	20	15/6	..	6 9 0
T.C.C. (10/−) ..	5	5	16/3	..	3 1 7
T.C. & M. ..	10	10	50/−	..	4 0 0
TelephoneMfg.(5/-)	9	9	11/9	..	3 16 7
Thorn Elec. (5/−)	20	20	21/3	..	4 14 1
Tube Investments	20	20	91/6	..	4 7 4
Vactric (5/−) ..	Nil	Nil	12/6	..	—
Vickers (10/−) ..	10	10	18/9	−3d.	5 6 8
WalsallConduits(4/-)	55	55	44/−	+1/−	5 0 0
Ward & Goldstone (5/−)	20	20	22/6	..	4 9 0
WestinghouseBrake	10	12½	65/−	..	3 17 0
West, Allen (5/−)	7½	7½	7/6	+6d.	5 0 0

* 5 per cent. tax-free. † Dividends free of Income Tax.

Stocks and Shares (*Continued from page* 28)

pany. He referred to the casualties that had occurred, and paid high tribute to the bravery shown in the execution of their duty by members of the staff.

British Electric Traction

At the recent meeting of the British Electric Traction Co., the chairman vigorously defended private enterprise as applied to transport on the roads. The British Electric Traction Co. owns more than 8,000 buses, which last year carried 1,400,000 passengers. Mr. Howley contended that conditions which applied in wartime afforded no guide to what could be done in days of peace. His speech is of interest to a much wider circle than that which is primarily concerned with road transport. Agreement will be general with his conclusion that, in peacetime, two essentials are economy and ready adaptability. "These," said he, "are best developed by private enterprise."

The price of British Electric Traction deferred stock at 1,075 is ten points lower on the week. The 8 per cent. preferred stock has changed hands recently at 165. Tilling Motor Services ordinary keep very firm at 35s., and shares in the other half of the previous partnership, the B.E.T. Omnibus Services, are quoted at 34s. middle.

Dollar Stocks

Brazilian Traction shares have been the centre of a good deal of speculative interest during the past week. The price, which stood at 25 in the middle of last April, has risen to 33. Optimism speaks of a possible quarterly dividend of 50 cents, making $2 for the year; and, if this is forthcoming, the present price of 33 will not look dear, having regard to the extent and the potentialities of the Brazilian Traction Co. Mention was recently made here of a movement now on foot for accumulation of dollar securities on behalf of people who think there will be further inflation in this country. The argument runs that these dollar stocks will afford a useful hedge against such a possible tendency. In quiet markets, the amount of support afforded to Brazilian Tractions has aroused no little interest, and a fairly lively speculative movement is in progress. Other South American stocks are dull: Anglo-Argentine Tramways issues have gone back, the income stock at 11 being two points down.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

F. BARTON and C. H. Mayer.—"Thermionic cathodes." 15581. December 3rd, 1941. (553832.)

A. S. Bonney and W. J. Adlam.—"Moulds or matrices for use in the formation of metal articles by electro-deposition." 14271. November 5th, 1941. (553871.)

British Thomson - Houston Co., Ltd.—"Methods of and apparatus for loading flash-lamps." 612/42. January 14th, 1941. (553840.) "Electric valve oscillatory apparatus." 5998/42. May 2nd, 1941. (553852.)

British Thomson-Houston Co., Ltd., and W. J. Scott.—"Operating circuit for low pressure gaseous electric discharge lamps." 15516. December 2nd, 1941. (553831.)

Chamberlain & Hookham, Ltd., S. James, E. A. Webb and W. F. Braines.—"Totalising means for use with a group of electricity meters or other electrical instruments." 6249. May 8th, 1942. (553853.)

Creed & Co., Ltd., and F. P. Mason.—"Telegraph systems." 14360. November 7th. 1941. (553875.)

J. A. Dorrat and Metropolitan-Vickers Electrical Co., Ltd.—"Electric arc-heating torches." 15820. December 8th, 1941. (553914.)

Dubilier Condenser Co. (1945), Ltd., and P. M. Paine.—"Electrical testing apparatus." 12855. October 6th, 1941. (553869.)

R. Goldschmidt.—"Electromagnetic sound-transmission apparatus." 13891. October 28th, 1941. (553955.)

Hazeltine Corporation.—"Television scanning system." 5575/42. July 1st, 1941. (553851.)

Hoover, Ltd., and W. J. McGlinchey.—"Electrically operated controls or indicators for machine tools." 15682. December 5th, 1941. (553877.)

Landis & Gyr. Soc. Anon.—"Fusible protective device for use in electric switches of small dimensions." Cognate applications 15257/40 and 15258/40. October 19th, 1939. (553862.)

J. Latimer and Metropolitan-Vickers Electrical Co., Ltd.—"Welding of aluminium-iron alloys." 15643. December 4th, 1941. (553876.)

R. A. Lister & Co., Ltd., and R. Werrett.—"Electrodeposition of metals." 17335/40. December 4th, 1941. (553827.)

Marconi's Wireless Telegraph Co., Ltd.—"Frequency or phase modulation." 6970/41. June 1st, 1940. (553828.) "Variable thermionic impedances." 273/42. January 7th, 1941. (553884.)

W. J. Marshall & L. H. Catt.—"Method of employing a rectifier in conjunction with a battery regulating switch." 15622. December 4th, 1941. (553833.)

National Carbon Co., Inc.—"Electrolytic apparatus and process." 9664/42. November 8th, 1941. (553897.)

Okonite Co.—"Electric cables." 8115/42. May 24th, 1941. (553857.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—"Circuit arrangements for the amplification and/or frequency transformation of electrical oscillations of ultra-high frequency." 16009. December 11th, 1941. (553838.) "Frequency doubling devices for high-frequency oscillations." 16010. December 11th, 1941. (553971.)

H. Read and H. Ellor.—"Trolley-vehicle overhead equipment." 15691. December 5th, 1941. (553836.)

S. Rosenthal.—"Electrically operated valve control gears for hydraulic or like presses." 2345. February 23rd, 1942. (553928.)

Standard Telephones & Cables, Ltd.—"Slow-operate electrical circuit." 4074/42. October 23rd, 1940. (553845.). "Electric wave amplification." 4477/42. December 28th, 1940. (553847.) "Electron-discharge devices." 8105/41. July 5th, 1940. (553866.) "Voice-frequency signalling systems." 5882/42. April 19th, 1941. (553935.) "Electron-discharge-apparatus of the cathode-ray type." 7499/41. June 27th, 1940. (553943.)

Standard Telephones & Cables, Ltd. (Western Electric Co.,Inc.).—"Electron-discharge devices." 4167. March 28th, 1942. (553846.)

Standard Telephones & Cables, Ltd., and W. Kram.—"Non - inductive electrical resistances." 15856. December 9th, 1941. (553966.)

Standard Telephones & Cables, Ltd., and A. J. Maddock.—"Radio-frequency circuit arrangements comprising amplifiers feeding into a common load, for example, a radiating antenna." 15857. December 9th, 1941. (553967.) "Antenna systems." 15896. December 9th, 1941. (553970.)

Standard Telephones & Cables, Ltd., T. R. Scott and E. C. Lee.—"Joints and terminations for electric power cables." 15710. December 5th, 1941. (553964.)

Telefonaktiebolaget L. M. Ericsson.—"Electrical means for the multiplication of variable quantities." 11003/41. July 5th, 1941. (553947.)

Telephone Manufacturing Co., Ltd., and L. H. Paddle.—"Electric frequency convertor systems." 16639. December 24th, 1941. (553973.)

L. V. Turner (F. A. Talbot).—"Snap action electric limit switches." 16095. December 12th, 1941. (553917.)

H. C. Westcott.—"Clamping the laminations of electric transformers." 14367. November 7th, 1941. (553909.)

Western Electric Co., Inc.—"Space discharge devices such as photo-electric cells." 978/42. January 25th, 1941. (553841.)

Westinghouse Electric International Co.—"Laminated magnetic core structures." 4724/41. April 26th 1940. (553864.) "Moving-coil electrical measuring instruments." 15016/41. November 27th, 1940. (553911.)

Wilson Welder & Metals Co., Inc.—"Heat control for arc welding." 7384/42. September 24th, 1941. (553855.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Orders Placed

London.—STOKE NEWINGTON. Electricity Committee. Accepted. Street boxes (£79).—Henley's.

ST. MARYLEBONE. Electricity Committee. Accepted. Cooling tower repairs.—Premier Cooler & Engineering Co., Ltd. Cables for three years.—Telegraph Construction & Maintenance Co.; British Insulated Cables; and Enfield Cable Works.

JOINT ELECTRICITY AUTHORITY.—Recommended. Supply of kiosks for a further twelve months on existing terms and conditions.—Crompton Parkinson.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Adlington.—30 houses at Acresfield and 20 houses at Fair View Estates for U.D.C.; Surveyor, Council Offices, Adlington, near Chorley.

Alnwick (Northumberland).—22 agricultural workers' houses for Rural Council; G. Reavell, Lloyd's Bank Chambers, Alnwick.

Amlwch (Anglesey).—30 houses for U.D.C.; W. Roberts, surveyor, Council Offices.

Atcham.—16 farm workers' houses for R.D.C. (£14,788); W. Whittingham, builder, Powlett Street, Wolverhampton.

Border.—Houses (14), Dalston, Cumrew, Cumwhitton, Hethersgill, Burgh-by-Sands, and Crosby-on-Eden, for R.D.C.; housing officer, Council Offices, 5-7, Victoria Place, Carlisle.

Brierley Hill.—Feeding centre (£400), Mill Street Schools; surveyor, Council Offices, Brettell Lane.

Burton-on-Trent.—Parish hall; Rev. A. G. F. Barker, vicar, St. John's Church, Horninglow.

Bury.—Public swimming baths, Bolton Street, for T.C.; J. Chadwick, borough engineer, municipal offices, Bank Street, Bury.

Caernarvon.—Conversion of building into British Restaurant and 250 houses for T.C.; H. Evans, borough surveyor, Guild Hall, Caernarvon.

Chesterfield.—Alterations to Ship Inn, St. Mary's Gate; Crown and Anchor, Sheffield Road, and Alma Inn, Derby Road; Brampton Brewery, Ltd., Brampton, Chesterfield.

Clydebank.—Wartime nursery for Corporation; burgh surveyor.

Coventry.—Communal feeding centre and extensions to school feeding centre for T.C.; D. E. E. Gibson, city architect, 1A, Warwick Row, Coventry.

Cumberland.—Classroom accommodation at Distington Church School; J. H. Haughan, county architect, Alfred Street North, Carlisle.

Dundee.—New block at King's Cross Hospital (£7,000); city architect.

Durham.—Additions, South Hetton Remand Home, for C.C. (£1,577); G. McCall, Ltd., builders, New Herrington.

East Hetton (Co. Durham).—Miners' canteen; George Henderson, Boldon Lane, East Boldon, Co. Durham.

Gateshead-on-Tyne. — Factory extensions; J. R. Rutherford & Son, Minories Joinery Works, Jesmond, Newcastle-on-Tyne, and T. Clements & Son, Selborne Gardens, Newcastle.

Hebburn-on-Tyne.—Office extensions; Palmers (Hebburn) Co., Ltd.

Hexham-on-Tyne.—14 agricultural workers' houses for Rural Council; Hetherington & Wilson, County Chambers, Newcastle-on-Tyne.

Kent.—Classrooms, dining hall and kitchen at Poverest Road School, Orpington; county architect, Maidstone.

Lancaster.—Improvements to public abattoirs (£1,000); F. Hill, city surveyor.

Luton.—Alterations and adaptations, St. Margaret's Home and Luton Institution (£1,632); T. Garrett, builder, Luton.

Workers' houses at Toddington, Caddington and Studham, for R.D.C.; James A. Murch, surveyor, 73, West Parade, Dunstable.

Manchester.—Extensions to St. John and St. Thomas R.C. School, Wythenshawe, for E.C.; J. B. Brez, chief surveyor, Education Offices, Deansgate, Manchester, 3.

Mansfield.—Alterations, Sutton Road; Quortex, Ltd., hosiery manufacturers, Sutton Road.

Middleton.—Rebuilding dye-works, Wood Street; Manchester Proofing Co., Ltd.

Day nursery, Sunny Brow, Archer Park; acting borough surveyor, Town Hall, Middleton, near Manchester.

Newcastle-on-Tyne.—Shelters, St. Mary's R.C. school, for E.C.; R. M. Chamberlain & Co., builders, Gateshead.

Building for City Council; Alexander Anderson, Ltd., Stanmore Road, Newcastle.

Wartime nursery, Armstrong Road, for City Council; R. G. Roberts, city architect, 18, Cloth Market.

Sculleries at various schools in connection with school means plan for E.C.; education architect, Northumberland Road, Newcastle.

Paisley.—Nursery, Ferguslie Park; burgh surveyor.

Prescot.—Girls' Grammar School for Lancs Education Committee; L. Evans, county architect, County Buildings, Fishergate Hill, Preston.

Richmond (Yorks).—Prefabricated building for central kitchen; J. W. White, county architect, County Hall, Northallerton, Yorks.

Rotherham.—Extensions to Ferham Council School for E.C.; V. Turner, borough engineer, municipal buildings, Rotherham.

Sedgefield.—British Restaurant, Sedgefield Village; R.D.C. surveyor.

Sheffield.—Cooking depot for T.C.; W. G. Davies, city architect, Town Hall, Sheffield.

Swinton and Pendlebury.—134 houses at Ivy Farm and Deans Estates and Croft and Knowles Square for T.C.; A. Cordwell, borough surveyor, Town Hall, Swinton, Lancs.